HANDBOOK OF
TEACHING SKILLS

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BY

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TO

MY MOTHER

WHO TAUGHT ME THE DIFFERENCE

BETWEEN "BOOK LEARNING"

AND EDUCATION

PREFACE

THIS book is intended for high school and college teachers.

It represents, in a sense, a protest against the view too commonly held that intelligent human beings learn as the lower animals do; i.e., by sheer repetition until stimulus and response, as we say, are joined together.

As against this, it advances the three-fold proposition that the true learning process is essentially a *thinking process*, at least at these higher levels; that the so-called laws of learning, which seem virtually to exclude human intelligence from the process of acquisition of knowledge, do not fully govern either the typical or the best learning of high school and college students; and that the kind of learning which these laws seem to demand is something from which good teachers everywhere may fervently wish to see the high schools and colleges of our land speedily delivered.

This conception of the learning process of adolescents and adults as one characterized by thinking rather than by mechanical memorization is by no means new. The best high school and college teachers have probably always been those who have secured the most and best thinking from their students. In this lay their strength; and the weakness of others has been that they were unable to replace memorization with thinking in the work of their students.

The suggested procedures whereby "learning by thinking" may be substituted for the traditional process of learning by repetition and recall are referred to in this book as *teaching skills*. Although they are definite as to the nature of the steps to be taken, they are not in any sense mechanized rules or processes. Rather, they call for the utmost degree of

initiative and resourcefulness of which any teacher is capable; and genuine skill in their use will come only through persistent, painstaking practice.

Two advantages seem to result from the formulation of these generalized techniques. Problem teaching, for which acceptable standards and methods have been painfully lacking, is reduced to the form of definite, rational procedures; and the serious mistake of allowing instruction in methods to end with a study of mere abstract principles is avoided.

If used not merely as a text in the methods class but as a handbook in connection with practice teaching, the book should enable students to judge their own work more intelligently and supervisors or critic teachers to offer more helpful suggestions for its improvement than could easily be done otherwise.

W. H. LANCELOT.

AMES, IOWA
July 20, 1929

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HANDBOOK OF TEACHING SKILLS

CHAPTER I

WHO IS A GOOD TEACHER?

THIS book is dedicated to the two-fold proposition that good teaching is concerned with the attainment of results that are permanent, rather than transitory, and that good teachers are those who leave impressions that endure in the minds and lives of their students.

As for knowledge, it is to be regarded merely as a means to the true ends which teachers should strive to attain. Yet so important a means is it to these great goals that here, too, permanent results are to be desired. It should, apparently, be taught so that it will be retained until it is needed in later life.

We know that most knowledge is not so taught. Indeed, it seems that teaching does not as a rule concern itself much with this matter of retention. There are even some teachers who hold that it is quite immaterial whether any considerable part of the knowledge taught to our children and youth is retained by them or not.

Against this view that retention does not matter much and may properly be left to take care of itself

runs an argument so forceful that thoughtful people can not well oppose it. Knowledge has one great function and apparently only one. It is used in thinking. It is literally true that without knowledge we cannot think. In all rational thinking, right decisions are determined by certain critical facts or principles. Unless these facts or principles are carefully considered, accurate conclusions can not ordinarily be reached; and of course such facts or principles can not be taken into account at all if they have been forgotten. It follows that good thinking is impossible in the absence of the knowledge upon which the respective decisions to be reached must turn, and further that retention of at least the more important facts is imperatively necessary if we truly desire to develop in our young people the ability to think well. Good thinkers must have, first of all, full minds. It is a poor kind of teaching, indeed, which does not concern itself with retention beyond the day of examination; and they seem clearly wrong who say it is a matter of small concern whether knowledge learned in school is remembered or forgotten. This assumes, of course, that the knowledge taught is well chosen in the sense that it will actually be useful to the students in later life.

Can We Secure Better Retention?

Is it possible to teach knowledge in such a manner that it will actually be retained by our pupils until they find use for it in life outside of school? Is it according to nature's process that knowledge acquired in school should remain so long in youthful minds?

Rather, is it not the natural thing for it soon to be forgotten?

Most experienced teachers apparently incline to the latter opinion. There are very many indeed who believe that it is as natural for young people to forget as it is for them to breathe, and that the one can no more be prevented than the other.

These teachers seem to have based their conclusion upon their experience with the more or less artificial work of the schoolroom. It would doubtless be better to consider, instead, the more natural learning process, which seems to operate mainly outside of school. It unquestionably yields a type of learning far more permanent than that of the schoolroom. Children are not often found making special, conscious efforts to memorize the knowledge that comes to them outside of school. Yet there can be no doubt that it is, in general, retained longer than that acquired in the classroom, or even that a considerable amount of it is retained permanently.

Nature's Answer and Its Significance

Every normal human being, for example, retains memories of incidents and experiences from childhood which will never be forgotten. Indeed, it is a common thing for the last days of aged people to be filled with recollections of these far-away days of their childhood; and to very many in their declining years the events of *early* life hold to the end a degree of vividness not generally attained by those of later years.

Even in the case of adults, actively engaged in the affairs of life, there can be no doubt that the larger

part of their respective stores of knowledge has in nearly all cases been acquired out of school rather than in, and that acquisition and retention alike have come without laborious effort of any kind.

Being interpreted, all this seems to mean that nature provides a painless learning process, which is quite different from the artificial learning process of the school, and that, however great may be the tendency to forget things learned in school, those learned in nature's way seem generally to be retained as long as they function usefully in the thoughts and lives of their possessors.

It is fitting, then, that we endeavor to search out and apply in our teaching work the laws that govern "natural" learning. In proportion as we are successful in doing this, we shall doubtless find our pupils retaining more and more tenaciously the knowledge which we have taught to them.

There is apparently small reason for regarding better retention as an impossible goal in teaching. Rather it will probably come eventually to be recognized as among the very first signs of truly skillful instruction. We may well hope for the day when teachers shall be judged by the amount of knowledge which their pupils retain and are able to use readily and skillfully in their out-of-school thinking, rather than by that which they merely acquire more or less temporarily.

The High Goals of Good Teachers

Out of the foregoing arises a numerous company of bold, disturbing thoughts. Information is *not* educa-

tion. The acquisition of information is *not* real learning. To require students merely to memorize information is *not* to teach. Our really skillful teachers are *not* those who are able to cram the greatest amount of knowledge into the minds of their students. To measure the efficiency of high school or college teachers by the sheer amount of information temporarily acquired by their pupils implies darkly a prostitution of true educational ideals.

Between mere information mongers and real teachers, a great, unfathomable gulf is fixed. For all true teachers see to it that the knowledge taught is assimilated, and, after this, that their students come to use it habitually in their spontaneous thought. Their pupils become as a result sound, careful thinkers. Their teaching does not end when their students have reached the "knowing stage" but is carried forward to the stage of applying, of using, of doing. Furthermore, their pupils are given enduring worthwhile interests, ideals and appreciations, all of which go to make their lives richer and more purposeful.

This is teaching; and these are the ends which all true teachers everywhere strive to attain. Let us say more. Good teachers everywhere actually do attain them in some considerable measure; and there are probably few among us who are older, whose lives have not at some time in the past been touched by one or more such teachers and thereby made more useful and noble.

The gaining of knowledge by the pupils is not, then, to be regarded as the true end of our teaching, but only as a *means* to the true ends, which lie beyond. Even so, knowledge is indispensable to the attainment of

these ends. Moreover, unless it is retained, our high, shining goals can not be achieved. Thus we meet the great crucial problem which this book seeks to answer:

How Can We Teach so that the Knowledge Acquired by Our Pupils Will Be Retained by Them until Needed in Later Life?

This is the first problem of every person who would be a good teacher; and hardly another can be found anywhere which lays upon our minds the same fascinating spell as we attempt to discover the hidden answer.

PROBLEMS FOR THE STUDY HOUR

1. Does it seem to you that any person should be able to teach well provided he knows his subject matter well?

2. A college instructor in meeting a class for the first time said: "You are not educated unless you can memorize. You must have exact information to be educated and you get that information by memorizing. I want you to memorize every word of my lectures." To what extent do his pedagogical ideas as expressed above appear to you sound?

3. By what signs or standards would you judge a teacher whom you were observing at work?

4. A well-known college educator, when asked what he regarded as the true *measure* of teaching efficiency promptly replied, "Acquisition of facts by the students." Do you agree with him?

5. Does the following statement by R. L. Stevenson seem to you to be essentially true, or false: "Here and there a Lord Macaulay may escape from school lessons with all his wits about him; but most boys pay so dearly for their medals that they never afterward have a shot in their locker and they begin the world bankrupt."

HELPFUL READINGS

DEWEY: Democracy and Education, Chap. 18.
KLAPPER: College Teaching, pp. 66–72.
PARKER: Methods of Teaching in High Schools, Chap. 2.
MIRICK: Progressive Education, Chap. 1.
DEARBORN: An Introduction to Teaching, Chap. 5.
THOMAS: Principles and Technique of Teaching, Chap. 19.
THOMAS: Principles and Technique of Teaching, Chap. 1.
BELL: Contributions to Education, pp. 342–350.
MIRICK: Progressive Education, pp. 230–248.
KILPATRICK: Foundations of Method, pp. 99–106.

CHAPTER II

HOW OUR MINDS RETAIN KNOWLEDGE

If we consider all of the multitude of problems that teachers meet, we shall hardly find another so crucially important as this one, a solution of which is here to be attempted:

"How can we teach so that the knowledge acquired by our pupils will be retained by them until it is needed in later life?"

The question itself shifts our thought from mere acquisition, which has long been accepted as the great end of the teaching process, to another of far greater worth. It is true that retention includes acquisition. Yet we should not overlook the fact that a very large part of what is acquired is soon lost by students generally. It follows that acquisition alone, as either a goal or a measure of the teaching process, is to be regarded as highly unsatisfactory.

If we should put to a group of experienced teachers of secondary or college subjects the problem stated above, we should receive a wide variety of answers. Among them are usually given on such occasions the suggestions which follow, or others whose meaning is, at least when considered in the aggregate, substantially the same:

SUGGESTED METHODS OF SECURING RETENTION

1. Require *much repetition* of the material during and after learning.

2. See that pupils give *close attention* during the learning process.

3. Require *intense effort and concentration* during the study period.

4. Have the material to be taught well *organized.*

5. Maintain a high degree of *interest.*

6. See that material is *recalled frequently* after it has been learned.

7. Require learning to be carried *beyond the "threshold of reproduction."*

8. Present material in a *novel* manner.

9. *See that pupils have the intention to master* when studying.

10. Give to the students the clearest possible *understanding* of the material that is learned.

11. Present material as *vividly* as possible.

12. Require *laboratory* work as a means of fixing all important truths.

13. Require *application,* as in project work.

14. See that many *associations* are formed.

15. Require that material be frequently *used in the subsequent thinking* of the pupils.

All of these appear, of course, to be acceptable methods according to our traditional notions of teaching. Whether all are really necessary to retention, however, is quite another matter; and as to this, such a group of teachers as we have mentioned will ordinarily disagree owing probably in part to the fact that their efforts in the past have been, in general, devoted

to securing acquisition rather than the high degree of retention that is being considered here.

As we examine the list of suggestions above, we shall observe that some of them are really included in others. Thus the eighth, which requires that material be presented in a novel manner, and the eleventh, requiring vividness, are seen to be really included in the fifth, which demands that high interest be maintained. Moreover, since attention depends upon interest, the second suggestion may be regarded as included also in the fifth. Thus the second, eighth and eleventh suggestions might apparently be dropped from the list. Other similar subordinate relationships may readily be found. However, it is probably better at this point for us to put the matter to actual experimental test, rather than to try to settle it by a process of harmonizing the conflicting opinions of others.

Putting the Matter to a Test

Suppose, for example, that we go to some old textbook, or notebook, used in a course taken two years or more ago and not utilized since as the basis of other courses, and choose from it a group of relatively important facts learned when the course was taken and *still remembered clearly.* Taking these facts then, one by one, let us determine as nearly as we are able which of the rules or suggestions listed above seem to have been applied in each learning process. That is, as we consider the first of our remembered facts, we shall try to determine as nearly as we are able whether the first of the fifteen rules above was actually applied when it was learned, then the second, and so on. When

we have finished with the first fact in this way, we shall have a list of the rules that seem to have operated in fixing it in our minds; and when all have been treated in this manner, we can easily see which rules seem to have operated in the case of all or nearly all of the facts.

The results of such a study will doubtless prove quite surprising. In general, we shall find that a considerable number of the remembered facts were apparently acquired with little or no repetition. This would mean, of course, that much repetition or drill can not be regarded as truly necessary to retention. In the same manner, we shall probably discover that all the other rules must be discarded as not essential, save perhaps the fifth, the tenth, the fourteenth and the fifteenth. These four will, in general, appear to have been applied in the learning of all or nearly all of the facts, whereas those remaining will have been applied in the learning of only a part of the remembered facts, or perhaps of very few.

Such results will not mean that the discarded rules are worthless, but rather that although they may be helpful in certain cases, they are not to be regarded as indispensable, as the four which are retained seem virtually to be. Moreover, they may be of very great value in securing acquisition, as distinguished from retention. Indeed it may be because of this that teachers generally have so great faith in them; but since we are searching for the conditions of retention instead, we must necessarily lay them aside as of relatively minor importance.

Neither shall we be satisfied to allow the inference as already drawn to stand. Rather there is quite

obvious overlapping as among the last three of the four rules. That is, *understanding,* which is required by the tenth rule implies *associations,* which are demanded by the fourteenth. Furthermore, *subsequent use in thinking,* called for by the fifteenth, implies merely the establishment by the mind of additional associations. We might, then, allow the fourteenth to stand for all three. It is, however, too general to be very helpful to us in our later work; and since the other two are relatively definite, it appears that we may with advantage retain them and drop the fourteenth instead.

It follows that our experiment would not merely have resulted in the elimination of most of the original list of suggested rules for securing retention, but that it would have given birth to the rather strange inference that in order to secure retention we must (1) maintain high *interest,* (2) give clear *understanding,* and (3) require *subsequent use in thinking* of the material learned.

Results in Conflict with Traditional Ideas

The foregoing inference, while clearly out of line with the opinions of many teachers, seems still in strange agreement with those of people outside of school.

Most people, for example, who are engaged in other work than teaching, hold rather strongly that they remember longest the things in which they are most deeply *interested;* that they very rarely forget that which they really *understand* clearly; and that *use of knowledge in subsequent thinking* really operates very

strongly to fix it in mind. Some of these people even express the belief that it is by some sort of combination of these three conditions that they have really gained the fund of general knowledge which has been acquired so easily outside of school and which tends to remain so permanently.

The views of teachers, on the other hand, are quite different from this. They seem generally to regard *attention,* for example, as a highly important matter, but interest as of secondary importance. Many believe that *repetition,* or drill, is one of the most effective of all means of fixing knowledge permanently in mind; that efficiency in learning is dependent very largely upon the degree of more or less painful *effort* put forth by the pupils at the demand of the teacher; and that very much indeed depends upon presenting the material in *logical, outlined* order so that nothing shall be given out of its appointed place. Indeed, teachers in general would probably agree that all, or nearly all, of the fifteen rules suggested at the beginning of this chapter are really important and should be observed; but it is quite certain that they would set some others well above the three which have been tentatively recognized above as the most important determinants of retention.

Can These Three Yield Retention?

Let us turn to consider whether the inference drawn above has any valid scientific ground. Is there really any sound reason why interest, understanding and subsequent use in thinking might in proper combination give relatively permanent retention, as the

test has normally seemed to indicate? Or, instead, is the inference in conflict with known scientific laws, and therefore to be regarded with doubt and suspicion?

Suppose we consider *understanding* first.

Psychologists believe that facts are fixed in mind by the associations, or relationships, which exist between them and other facts. A given fact bearing no relationships to other facts, for example, can be retained only with the greatest difficulty, if at all; but if relationships between it and other facts are once clearly discerned the mind becomes strangely able to hold to it more or less tenaciously.

Just why the establishment of relationships, or associations, between a given fact and others should bring about its fixation in this manner is beyond our understanding. Yet there can be little doubt that this is true. Moreover, it is equally clear that these relationships, or associations, are established as a result of thinking. Indeed, when our minds are thinking, they seem simply to be engaged in discovering and establishing relationships between facts.

Now when we understand any fact, principle or law, we have thought it through until its important relationships to other facts, principles or laws have become clear. In particular, we have established the most important of all the various kinds of relationships that are known to exist—those relating to cause and effect. For we truly understand a thing only when we have seen clearly the reasons why it is true, or let us say instead, when we have discovered its causes.

It follows that true understanding involves an orderly system of associations of the most important kind, or type. If knowledge is fixed in our minds by

associations, as seems unquestionably true, it follows that from those which are best, systematically organized, should come the highest possible degree of retention. As we look thus into the scientific aspects of the matter we can easily conclude that understanding is probably one of the chief determinants of retention.

After this, the part which *subsequent use in thinking* plays in the fixation of knowledge is quite easily seen.

When thinking, we are really engaged in establishing *associations.* It follows that each time a given fact is woven into a thought process, new associations are really formed between it and other facts. To think is to multiply associations; and it must follow that the number of associations established between a given fact and others, and therefore the tenacity with which that fact will be held in mind, is determined largely by the frequency with which it is *subsequently used in thinking.* We must conclude then that this, like understanding, may and probably does play the decisive part in retention which has been ascribed to it above.

The indicated role of *interest* in the fixation of knowledge presents a problem somewhat different from those considered above. At first thought, it is not easy to see why it should function in the important manner indicated in the test suggested.

This is probably due to our common failure to recognize one of the most important of all the functions of interest. *It stimulates and guides our spontaneous thought.* In proportion as it exists, we tend to do intensive, purposeful *thinking;* for always when we think spontaneously we think about that in which we are *interested.* It seems beyond question that in-

terest normally determines what we shall think about and how much we shall think about it.

All of this means, of course, that in interest we have the great determiner of what particular associations shall be formed in our thinking, and how well they shall be formed; and this in turn is only another way of saying that interest really determines what facts we shall retain and what ones we shall forget. If we are deeply interested in any bit of knowledge, we shall think about it often, not merely when it is assigned for review in school but at divers other times; and by this thinking it will, because of the new associations formed, be more and more firmly fixed in mind.

It follows that in *understanding* and *subsequent use in thinking* we seem to have nature's own means of fixation of knowledge, since by them associations are formed. Likewise in *interest* we have nature's unfailing urge, which really causes the mind to select the necessary associations and to endeavor spontaneously to establish them.

In this strange trinity, then, we seem to have found the true basis of nature's "painless learning process," of which we have heard before. We can hardly fail to marvel at its simplicity and its quiet, unerring operation.

PROBLEMS FOR THE STUDY HOUR

1. Assuming that most of the information taught in the average course is forgotten, would you expect to find all students tending to remember the same facts and to forget the same ones?

2. If the hypothesis is true that retention is determined by

interest, understanding and subsequent use in thinking, which of the two facts below would probably be better retained?

a. A pendulum clock tends to run faster in winter than in summer because of the contraction of the pendulum rod which results from the lower temperature.
b. The velocity of light is approximately 186,000 miles per second.

3. Choosing three well-remembered facts from a course taken by you in high school and not taught since, try to determine what ones of the conditions named at the beginning of this chapter attended its acquisition. On the basis of this test, determine whether your retention of the facts examined seems to have been brought about wholly or mainly by interest, understanding, and subsequent use in thinking.

4. Under what circumstances may a teacher feel that he has enough interest in his class and that he should not attempt to develop more?

5. If the hypothesis evolved in this chapter is true, what influence, if any, should it have upon the selection of the subject matter to be taught?

HELPFUL READINGS

PYLE: The Psychology of Learning, pp. 141–155.
PARKER: Methods of Teaching in High Schools, pp. 336–341.
SNEDDEN: What's Wrong with American Education, pp. 42–47.
THOMAS: Principles and Technique of Teaching, pp. 210–218.
McDOUGALL: Outline of Psychology, pp. 310–311.
KILPATRICK: Foundation of Method, pp. 30–31.
KILPATRICK: Foundation of Method, pp. 72–74.
KILPATRICK: Foundation of Method, pp. 156–159.

CHAPTER III

OUR HYPOTHESIS AND THE TEACHING SKILLS

It must be apparent that if the thought of the preceding chapter is sound, and if the inference which emerged therefrom is true, a radical readjustment of our traditional views of teaching is called for.

We shall state this inference in the following form:

Retention of knowledge by high school and college students depends upon and is determined by *interest, understanding and subsequent use in thinking.*

It should be clearly recognized that this has not actually been proved, notwithstanding that a considerable amount of confirmatory evidence not cited in the last chapter has been gathered, and that for this reason it can be regarded at best as only a working hypothesis.

Whether or not it is accepted in the form in which it is stated is immaterial. Its essence is that each of the three conditions named bears so vital a relation to the permanent fixation of knowledge that it should be regarded as an indispensable characteristic of all good teaching. To this perhaps most persons will agree, though some may make the reservation that, in certain cases, one or two rather than all three might yield relatively permanent retention or that of the three named not all are equally potent in the fixation

of knowledge. Some, too, may feel that still other factors may ultimately come to be regarded as essential to the process of fixation and that the door should not be closed to these by any hard and fast formulation at this stage of our thinking.

Such reservations are fully warranted. Yet they should not divert our minds from the apparently decisive role of the three factors, or conditions, named as determinants of retention of knowledge by adolescents and adults.

Inference Upsets Standards of Selection

It becomes quickly evident as we consider the implications of the inference stated above that it might properly exercise a profound influence upon our selection of subject matter to be taught.

Our modern school of curriculum makers, for example, have rather generally advocated *usefulness* as the chief, or even the sole, standard by which subject matter should be judged. It is apparent that our inference, or hypothesis, would put three standards in the place of this one; for it would require that the knowledge to be taught should be not only *useful,* as demanded by the third factor or condition named, but *interesting* and *understandable* as well.

This is in strange agreement with the views of Dr. Frank McMurry, whose memorable address[1] at Atlanta, in 1904, marked the beginning of the fruitful curriculum-making movement to which so much attention has been given during the last two decades.

[1] See Proceedings of the National Education Association for 1904, page 194.

Dr. McMurry named on that occasion four qualities or characteristics, which all worth-while subject matter should possess, holding at the same time that if any one were lacking the knowledge should be rejected as not fit to teach. According to his statement all knowledge taught—

(1) Should be *interesting.*
(2) Should be *related* to other knowledge.
(3) Should be *comprehensible.*
(4) Should be *useful.*

A moment's scrutiny shows us that this list of desired qualities is in striking harmony with our own inference as stated above. For, aside from demanding the quality of *interest,* Dr. McMurry required (1) that *relationships* must exist between the knowledge taught and other knowledge, which of course makes possible *understanding* and *subsequent use in thinking;* and (2) that it be comprehensible, that is, capable of being *understood.* It follows that since the terms are identical, the two formulas are virtually one.

The issue involved is really one of much importance. At first thought, it seems that any or all knowledge that is actually known to be useful might well be taught. But should we teach knowledge that *can not be retained* by normal human minds, as seems to be the case if it is not interesting or understandable? Manifestly, if we wish to secure retention, we must start with knowledge that is capable of being retained; and it is quite clear that if we endeavor to teach knowledge that can not be retained, our efforts are largely if not altogether wasted.

A Basic Change in Teaching Methods Demanded

Despite what has been said, it is of course true that the inference drawn herein must influence us most, not in our selection of the knowledge to be taught, but in the method to be used in teaching it.

It is clear that the hypothesis would, if actually observed, bring about a general displacement of the artificial learning process of the schoolroom by another approximating, at least, the so-called natural process.

Let us examine the hypothesis more closely.

Its first requirement is interest. Its obvious demand is that we secure and hold in some way and *at all times* the genuine interest of our pupils. Furthermore, this is not a single task but must be regarded as, in a true sense, two in one. For it is necessary not only that we hold the interest of our students in the *daily work* of the classroom but also that we develop or build in them those *enduring, worth-while interests* which we wish to see them acquire in school and keep through the years of later life.

Turning to the second and third conditions of retention named in the hypothesis, namely, *understanding* and *subsequent use in thinking,* we note that both imply the control of thought, which doubtless defines the second great function of the teacher. It is for him to guide and direct the thinking of the class; and we should keep in mind that this ought to be the typical if not the sole activity of the school because it constitutes within itself the true learning process. That is, it is the process by which associations are formed;

and it is by these that all knowledge is fixed in the minds of our students.

Let us carry the thought a little further. The responsibility of the teacher does not end with the mere direction of thought so that the chosen knowledge is firmly fixed. It is for him also to develop in his students superior thinking ability. They must not only be kept thinking, but thinking *well*. Thus will they be led up gradually to the point where they may be depended upon to think accurately and soundly in the affairs of life.

If this seems impracticable and visionary, our own modes of thinking may need readjustment. The ability to think well is a very first fruit of all true education. If we are not producing it and if we doubt even our ability to do so, then indeed is the education we seek to give illusory and futile. That education can not really produce superior thinking ability is the unthinkable thing, rather than that it can and should do so, once we have seen teaching for what it truly is.

Despite our misgivings, teaching of this kind is extremely simple in its essential features. He is a good teacher who holds at a high pitch the interest of his class; who builds in them lasting, worth-while interests; who leads them into a true understanding of the knowledge acquired; and who develops in them the ability to think well in dealing with new situations and problems of whatsoever kind. Neither does this mean that he is merely to *follow* the interests of his pupils or to allow them to think at their own level and in their own irresponsible way. His role is very different indeed from this. It is to guide them into constantly better interests and constantly better think-

ing, rather than to follow weakly in their wake, allowing them to be led by their own transitory impulses into activities which can not raise them above the dead level of their own immature intellectual life.

The Specific Skills That Teachers Should Have

It turns out, however, that the control of group interest and the control of group thinking are apparently ends whose attainment calls for the very highest order of human skill. Whereas the teaching of the past has been largely a matter of mechanized processes and devices, teaching of this kind refuses to become mechanical or to follow fixed rules of any description. Yet it is true that certain general but effective methods, or procedures, are known for the attainment of each of the great essential ends of teaching; and it is to these methods, referred to herein as *teaching skills,* that most of the remaining chapters of this book are devoted.

Thus we shall recognize six distinct ways or methods, all of which are highly effective, for securing and holding the interest of our pupils in their *daily classroom work.* They are:

(1) Making *external connections,* that is, connections with things which are outside the subject of genuine interest to the class, and from which interest may therefore be drawn into the material that is being studied.

(2) Replacing memorization or traditional lesson learning with *interesting thinking.*

(3) Involving the *natural impulses.*

(4) Making numerous, strong *internal connections* to the end that the course may not consist of a series of unrelated

fragments but may instead be bound into a single organic whole in which each part is properly related to every other part.

(5) Arousing the *feeling of need* for the knowledge to be acquired.

(6) Establishing and maintaining *suspense* whenever group thinking is under way.

In addition to these, which have for their purpose the control of interest in daily classroom work, a distinct technique is given for the development of the large, permanent interests which we wish our pupils to acquire.

In the same way a number of skills which are recognized as extremely helpful in the *direction and control of the thinking* of the class are designated and techniques are given for using them. This group, six in number, includes the following:

(1) Developing in our pupils the ability to think well.
(2) Finding, judging and using problems.
(3) Putting the problem before the class for study.
(4) Planning for the class discussion.
(5) Leading the class discussion.
(6) Questioning.

Finally, two techniques are given for skills which are not included in the above major groups but which must still be regarded as of very great importance in teaching. These two are:

(1) Selecting the knowledge to be taught.
(2) Measuring the results of the teaching.

Thus we have a list of fifteen skills, all of which grow directly out of our hypothesis that the fixation of

knowledge depends upon interest, understanding and subsequent use in thinking, and all of which for this reason bear a vital relation to good teaching. To each of these will be devoted one of the remaining chapters of this book.

CHAPTER IV

DRAWING INTEREST FROM OUTSIDE SOURCES

If we study the methods of teachers who are notably skillful in securing and holding interest in their daily classroom work, we find in nearly all cases that the interest aroused is actually derived in large part from external sources. They have gone out of the textbook and found in the world outside certain human experiences which are interesting to virtually everybody, which are in some way plainly related to the material being studied, and which may for this reason be appropriately introduced during the class discussion.

This method of drawing interest into our class work from outside sources, which is spoken of here as *making external connections,* is highly effective and widely applicable. Although some dangers may attend it, they are trifling by comparison with the great value of the method when applied by a thoughtful and well-informed teacher.

A brief technique for using this important interest skill in high school and college teaching is given below:

TECHNIQUE FOR MAKING EXTERNAL CONNECTIONS

1. Take advantage of such opportunities as may occur to connect the facts being studied with interesting *persons* and *events.*

2. Connect with *topics or facts* in other courses which have been found interesting.

3. Introduce, whenever possible, what is known as *"human interest."* This method requires that the knowledge be related in some way to actual human experiences and difficulties.

4. When teaching any given principle, search out and use if possible one or more interesting *applications* of it. In general, try to teach principles and applications together; or if they are taught separately see that the two are in every case *closely associated* in the minds of the students.

5. Make proper use of *humor*.

6. Avoid, most carefully, making any connections with uninteresting things.

The Law Upon Which This Technique Rests

If we are truly interested in any given subject or thing this interest flows, or spreads, into any other thing as soon as a relationship between the two is clearly discerned.

This apparently represents one of the most fundamental of all known laws of interest. Its essential requirements, as will be noted, are that in the first of the two related things we must be genuinely interested, and that the relationship between the two must be entirely clear to our minds.

In applying this law, then, in a given case we have only to find a thing outside the course in which the young people are already generally interested, and then to make it clear to them that the thing which is being studied is really related to it. When this is done the flow of interest into the new thing seems nearly instantaneous.

This requires, of course, that the teacher search

far and wide for interesting events, incidents, experiences and so on from which interest may be drawn into his course. In proportion as he has read widely, or traveled, or otherwise made himself familiar with the many interesting phases of life outside of school, he will be able to bring into his classroom work a larger stream of this interest from external sources.

Persons and Events as Sources of Interest

Interesting *persons,* living and dead, are beyond number. They may or may not be the conspicuous characters of history. Indeed, a peasant maid may be as interesting as a queen, or an aviator or football hero, as a world-famed conqueror. With all of history and the entire living generation of mankind to draw from, there is virtually no limit to the number of truly interesting persons who may be made to figure in an entirely legitimate way in classroom discussions.

In the same manner the number of interesting *events* transcends all thought. Events are not by any means limited to those found in the pages of history. A dramatic incident observed on a street corner or perhaps the brave efforts of a tenement girl to rear her orphaned brothers and sisters may be more interesting by far than the fall of a dynasty or the decline of an empire. It follows again, then, that such events or occurrences may be drawn from human life in any number that teachers may desire.

Drawing Interest from Other Subjects

The suggestion that we should make connections with interesting things in *other courses* may well be

observed carefully in our teaching. Too often such connections are overlooked. Yet by them we can bring interest into our work and at the same time help our students to see clearly the relationships existing between the new material and that which they have learned elsewhere.

Human Interest an Unfailing Source

In "human interest," so-called, is another external source of interest of transcendent possibilities. It requires that the knowledge which we teach shall be "humanized," in the sense that it is in some way related to human life, rather than taught as something abstract and unrelated to human affairs. It is illustrated in the Parables, where the lessons taught are woven into the problems, difficulties and experiences of men and women in such a manner as to make their interest nearly irresistible. It is clear that our great accumulation of abstract truths, principles and laws needs to be made alive for our pupils in a similar manner.

Interesting Applications as Points of Origin

One of the most effective of all plans for making external connections is that of pointing out certain interesting *applications* of the principles or laws under consideration. The study of principles and applications *together* is in general interesting to keen, active minds, probably because of the cause and effect relationships involved, whereas the study of either without the other is usually, though not always, quite seriously lacking in interest. It follows that they

should not be divorced and taught at different times as is so commonly done. Rather, in the teaching of the abstract sciences, for example, the general applications of the principles studied should be kept prominent; and in the teaching of applied subjects, as law, engineering, homemaking or agriculture, specific applications should have first place but underlying principles should still be kept constantly and clearly associated with these applications. This is, of course, only another manner of saying that the missing one of the related pair, that is, principle and application, should in all cases be found and woven in some way into the thought of the class, and that in such a case an external source of interest has ordinarily been drawn upon.

The Value of the Humorous Situation

The suggestion that teachers should make proper use of *humor* and that this constitutes an application of the technique for external connections may be at first somewhat puzzling. Yet it is clear that interest may really be drawn from a genuinely funny incident or joke. As we reflect, it becomes apparent that in such cases the "funny situation" has itself functioned as an external source of interest, and further that such situations are for some inexplicable reason peculiarly interesting to the normal human mind. When we consider the countless number of such situations we find again an inexhaustible external source of interest. Neither should it be avoided by skillful teachers since humor is apparently an indispensable ingredient of all good teaching and worth-while living. Too many teachers, by their unbroken, owl-like solemnity, destroy

the interest they most earnestly wish to have; and too many pupils regard their teachers as but partly human because a bit of fun now and then seems to pain them so greatly.

The Need of Examining the Sources

It will be observed that the technique for making external connections seems to place a significant limitation upon one of the most ancient and respected of all the principles of pedagogy—that in teaching we should proceed "from the known to the unknown."

If this rule is followed, it may easily happen that the thing that is being taught will be associated or connected with something actually uninteresting to the pupils. To do this is to destroy interest; for just as we may draw interest from a thing that is interesting, so we may draw *lack* of interest from an uninteresting thing. That is, to connect a new thing with an uninteresting source is to make the new thing uninteresting. This, of course, is something that very often happens under the time-honored rule that we should proceed from the known to the unknown. It seems therefore that this rule might properly be restated to the effect that we should proceed from that which is both *known* and *interesting* to the pupils to that which is unknown to them.

At any rate, it cannot be emphasized too strongly that the teacher should in every case examine most critically the source from which he seeks to borrow interest. Clearly, this source must itself be interesting, else no interest can come from it. Many who seek to apply the technique for external connections seem to make the mistake of trying to draw interest

from sources which are only slightly or even not at all interesting.

Still another error should be mentioned, namely, the use of external sources that bear no actual relation to the material that is being studied and that can not therefore be connected with it. Unrelated stories, for example, are sometimes used. As a means of entertainment they may be acceptable; yet they have, of course, no legitimate place in teaching.

PROBLEMS FOR THE STUDY HOUR

1. With 100 as a basis, how would you score the average high school teacher upon the ability to control classroom interest?

2. How much interest should we try to have?

3. Name three or more recent events that seem to you sufficiently interesting to be suitable to use as external sources of interest.

4. Choose some specific topic in a subject which you expect to teach, and describe two or more good external connections that might be made in teaching it.

5. In following the traditional rule of proceeding from the known to the unknown, does it seem to you that teachers very frequently connect new material with that which is uninteresting?

6. Can you name other good external sources of interest than those included in the technique?

7. A college instructor makes it a practice to open each day's work with a humorous story, which may or may not bear a relation to the discussion that follows. Would you approve of this method of arousing interest?

HELPFUL READINGS

CHARTERS: Methods of Teaching, pp. 154–156.

JAMES: Talks on Psychology and Life's Ideals, Chap. 10.

CHAPTER V

THE TRANSITION FROM MEMORIZATION TO THINKING

We seem to have overlooked too long the obvious truth that the memorization of facts is a process that is essentially uninteresting to adolescent and adult minds.

On the other hand, the process that is inherently interesting to normal minds at this age is active *thinking*. Their leisure time is filled with it. This is true notwithstanding that such thought tends to be lacking in concentration and conscious direction. Given freedom to choose its own activity, the mind probably never quits thinking.

Thus it appears that the process by which knowledge is fixed is made to go on ceaselessly by the natural drive of interest. Our minds can hardly conceive a more perfect plan than this. Neither can we see why schools have so long put in its place the artificial process of learning by repetition and recall, at least at the high school and college levels.

Whatever the reason may have been, it seems clear that the traditional learning process should be modified. Memorization should give way to interesting thought as the characteristic activity of the school. And when we have brought this about, we shall find that we have banished at a single stroke many of the

greatest difficulties met in our efforts to secure and hold interest.

A technique whereby this may be accomplished is given below:

REPLACING MEMORIZATION WITH INTERESTING THINKING

Endeavor to replace rote memorization with thought of a kind that is intrinsically interesting. Specific rules that will contribute to this end are:

1. Avoid assignments calling for mere learning of facts, as such.

2. Introduce each essential fact, principle, or law by a concrete problem involving it. This inductive problem should be solved, if possible, by the students, after which they should determine how general is the application of the fact, law or principle thus brought to light.

3. After the fact, principle or law has been established by means of the inductive problem, give reasoning or judgment problems as may be needed to develop the desired degree of skill in applying in these processes the newly discovered truth.

4. At some time later, involve the fact, law or principle in one or more creative problems—problems calling for original planning, as in design, management, etc.

The Broad Implications of the Technique

There is apparently but one way to lead students—or others, for that matter—to think. It is to give them something to think about. Merely to tell them to think about a topic that is being studied is in itself altogether futile. On the other hand, if they are given a problem that lies within their power to solve they

will undertake it as the regular and natural thing to do.

By asking questions we can induce thinking. Yet the so-called "fact question" does not do so at all. It follows that the questions used should in general call for thought, that is, for a *decision* of some kind that can be reached only by a thinking process. In general, too, the broader the scope of such questions, the better the thinking that will be required. A problem, in the sense in which this term is used in the technique above, is merely a thought question of relatively broad scope. Whereas a thought question, for example, might be answered within, let us say, a minute or two, a problem might require many minutes or even hours. Of course there is no arbitrary point at which a thought question attains the dignity of a problem, just as there is no definite point at which a boy becomes a man. Neither is this an important distinction to make. Far more important is it that we distinguish carefully between true problems, whose answers come by thinking, and those fact questions whose answers, though difficult to find, are still to be ascertained by merely searching them out of books. These, of course, are not problems at all. Neither does anything that is said in the following pages have reference to questions of this kind. Perhaps as much as should be said here concerning them is that if fact questions are to be used it is better that they, too, should be relatively broad as to scope.

Our technique provides that, in general, all teaching should be by means of problems. Whether this is possible in all cases will be considered elsewhere. It may be said here, however, that the suggestion is at

least far more practicable than many are inclined at first to believe. Furthermore, if true problems can not be found in any given case, it is always possible for the teacher to employ thought questions instead. Thus he will make necessary the acquisition of the facts, without which the required thinking can not be done; but beyond this, he will at the same time be requiring the *use* of these facts in processes of reasoning or judgment.

Finally, the technique stipulates that the thinking must be interesting. This is in frank recognition of the fact that not all of the thinking done in connection with school problems is interesting; and it raises one of the most significant of all the questions that a teacher can meet. Just what kinds, or types, of thinking are intrinsically interesting to the human mind? In the answer to this seem to be found certain fundamental principles determining the nature of the problems that should be used in school work.

Searching for a Hidden Truth

We are so constituted that we experience some sort of inner satisfaction in the quest of an unknown truth. This seems, in fact, to be the occasion of much of our thinking. We observe some phenomenon or occurrence which we do not understand, and immediately set about discovering its cause. It may be the burning of an empty garage, the strange actions of a neighbor's dog, an unexpected turn in the markets, the death of a lilac bush or what not. If we do not understand it, we endeavor to think out its probable cause—to determine the reason for it. It may or may not

be a matter of personal concern to us. Indeed, much of the thinking of this kind which we do seems to relate to questions of no actual personal consequence to us.

Thinking of this kind is even seen in the five-year-old child who is continually asking "Why." By this question he is asking for the reason, or cause, of things that he does not understand. Neither does it seem to matter much whether or not they really concern or affect him in any way.

The strange manner in which an unknown or hidden truth lures our minds on and on until perchance the truth is finally revealed to us is not easy to understand. It is apparently to be regarded as an inborn impulse, by which we are induced to perform cause and effect thinking, since it leads us normally from an observed effect back to its underlying cause. Moreover, this cause very often turns out to be a general principle, law or truth having application in many other situations. It is as if our minds, confronted with a puzzling observation, sensed in some occult way that behind it lies a concealed truth of great possible worth to us in our efforts to subdue the earth. Whatever may be the explanation for it, we should recognize the fact that this thinking, which we call *inductive,* and which starts with observed effects and endeavors to work back to and discover their causes, is strangely interesting to our minds.

Reasoning and Judgment to Develop Desired Skill

A second type of thinking that seems to command our interest is that which leads to a desired power or skill.

If a typical high school or college student really desires to become, let us say, a skillful mathematician, he will be genuinely interested in mathematical problems and will enjoy solving them. The desire for the skill seems to be the determinant of the interest in this case; for, if it does not exist, the same problems may be regarded by him with aversion and dread.

The same tendency is, of course, observed in older people. The man who is deeply interested in finance and who desires to become a skillful financier will devote his time and thought to the consideration of financial problems of nearly every conceivable kind. The manufacturer who desires to develop high ability in his field gives in the same manner his best thought ungrudgingly to problems of every description having any sort of relation to his business. Examples could, of course, be multiplied indefinitely. Through all, one common character would run. In all cases, we would have people engaged in reasoning or judgment processes leading to skills which they truly desired to attain.

It follows that we have in this a second general type of thinking that is interesting to the normal mind.

Our Interest in Original Planning

A large part of the thinking done by nearly every person consists in planning for the accomplishment of desired ends. For nearly every daily task some planning must be done.

Such thinking is called *creative*. Its product is a *plan* of some kind. It may be a plan for the making of a spring garden, for securing an education, for dis-

posing of a discarded overcoat, for building up a business, for making an apartment home-like, or for the attainment of any other desired end whatsoever.

There is something about this creative thinking that fascinates our minds. Why this should be we do not clearly understand. Yet it is unquestionably true that normal people, young and old, like to do it. It is a distinguishing characteristic of really great minds; but we likewise see it in little children "playing house" or in older ones planning for a picnic or for a party.

In high school and college work, problems calling for creative thinking are exceedingly effective from the standpoint of interest. Moreover, such problems may be found in virtually all subjects that are really worth while. If this is not true in the case of any given subject, it seems in general to mean that it contains nothing that can be used by us in meeting and solving new situations in life.

Interesting Thought in Our Racial Past

Although there may be other types of thinking that are intrinsically interesting, the three named above seem to be by far the most important. Moreover, reflection shows us that they have probably played a momentous role in the evolution of the human race.

When primitive man, for example, began to look behind the phenomena observed in nature about him and to try to discover their causes, he was taking a very long step indeed away from brute creation, for this is something that the brutes do not seem to do. By it he came to acquire a knowledge, at first of the

simplest of nature's laws but later of others, until now he has a numerous group of natural sciences, whose influence upon his life surpasses our farthest thought. This is only to say that the tendency to inductive thinking, contracted in some mysterious way at a remote time in our shadowy past, has made human beings a race apart from all other creatures and given us our dominion over them.

By inductive thinking man has come into a knowledge of the first causes of things; but we should note also that, once this knowledge had been acquired, he apparently began to examine other situations than those from which it had been derived in order to discover just how it was operating there. So a new power came to him, and one which he very much desired; he became able to understand, to interpret, and even to foresee the occurrences and phenomena of the natural world upon which his precarious existence depended. By such reasoning and judgment processes as these his knowledge was broadened, and he became able to apply his newly discovered laws and principles to situations which had previously baffled him. Thus we see in this tendency to devote ourselves to reasoning and judgment the processes whereby we attain valuable new powers or skills that form still another decisive factor in the rise of our race to the place of power and eminence it now occupies.

Finally, we should note that by our inborn urge toward *creative thinking* we have been led into an age-long search for better ways of overcoming our difficulties and surmounting our limitations. It is through this impulse that we have become able to take the crude, raw materials of nature and make them

over into telephones, aeroplanes, skyscrapers and innumerable other useful things. In the wondrous trinity of thought, this is the one by which we have actually been brought into our present mastery of living and inanimate nature.

How We May Have Interesting Thought

In the light of the foregoing analysis, it is not hard to believe that the three types of thinking named in our technique have some strange power to grip the human mind, born perhaps of our racial past, and also that these types are of transcendent value in human life.

It is true that such thinking, save perhaps as to reasoning, is not done very much in our secondary and higher institutions. Yet it is quite apparent, as we shall see later, that it can be made the characteristic activity of the school. That is, problems calling for thinking of the three types indicated can apparently be made the regular means of instruction in virtually every subject; or if this should prove impracticable in any case, then thought questions, calling for the same kinds of thinking, may be used instead. It is difficult indeed to understand why, of all school subjects, only mathematics and to some extent the physical sciences have been generally so taught in the past.

Thus we can, if we desire to do so, turn from the deadening lesson-learning and lesson-reciting process to the process which lays upon the minds of our students a spell that they can not well shake off, and which at the same time enables them to retain and to use the knowledge that is being acquired.

PROBLEMS FOR THE STUDY HOUR

1. To what extent do you believe it to be actually possible to replace memorization with interesting thinking in high school and college work?

2. Is there danger that, if we replaced fact questions with thought questions or problems, the facts would not be learned by our students?

3. What are the most serious difficulties to be expected if a teacher endeavors to change from fact to thought teaching?

4. What do you understand to be the meaning of the following statement by R. G. Ingersoll: "Roses would be unbearable if in their red and perfumed hearts were mottoes to the effect that bears eat bad boys and that honesty is the best policy."

5. State five problems encountered by you recently in which you sought to discover some unknown fact of either great or small consequence.

6. State five problems recently met by you that call for creative thinking.

7. Can you suggest any other way to get students to think than to put before them a question or problem demanding thought?

HELPFUL READINGS

AVERILL: Elements of Educational Psychology, pp. 26–36.
DEGARMO: Interest and Education, Chap. 15.
PARKER: Methods of Teaching in High Schools, pp. 350–352.
PRINGLE: Methods with Adolescents, pp. 96–98.
KILPATRICK: Foundations of Method, pp. 64–65.

CHAPTER VI

THE NATURAL SPRINGS OF INTEREST

THE teacher who sincerely desires to lead the interests of his young people effectively and to develop in them new interests that will endure quickly discovers that this can not be done through the use of devices, such as have been generally advised in the past in connection with the traditional teaching process.

Rather, he must reach within and touch the secret springs of human purpose and thought. This is what good teachers really do, as we can testify who have been so fortunate as to have been taught by them. In some strange manner they have seemed to stir our deeper feelings and to give us new desires and motives for work.

The key to the mysterious power of such teachers may apparently be found in their skillful use of the inner impulses with which all normal people seem to be endowed.

A technique is suggested below, which, if applied habitually, will enable teachers to acquire some degree of skill in the use of these impulses in their classroom work.

INVOLVING THE NATURAL IMPULSES

In planning any given study assignment, or class exercise, endeavor to involve strongly at least three or four natural

impulses, or even more than this number if possible. In general, the following suggestions will be found helpful:

1. Have before you at all times a list of the natural impulses that are most useful in teaching. Such a list should include the following:

Activity	Imitation
Love of Nature	Love of Approbation
Curiosity	Altruism
Wonder	Ownership
Creativeness	Competition
Gregariousness	Self-advancement
Sympathy	Love of Prominence

2. In laying plans for any given laboratory exercise or class discussion, refer to the foregoing list to determine what particular impulses may be most easily and strongly involved.

3. Later, in guiding the thought of the group, see that these impulses are actually aroused as planned.

4. Be constantly alert for passing opportunities in the midst of class discussions to involve the natural impulses, and make use of such occasions, whenever met, for further stimulation of interest.

Some Impulses Not Generally Understood

In the foregoing technique, a number of the impulses which are named seem to demand definition, since loose or mistaken conceptions of them appear to be generally held.

The impulse of *activity,* for example, refers to activity of either body or mind. Thus a pupil engaged in thinking is as truly active as one who is playing tennis.

By *love of nature* we refer to the universal interest of human beings, whether old or young, in their

natural surroundings. Given respite from work, as in vacation time, they go to the lakes, woods or mountains; and even on their weekly day of rest they seek nature's beauty spots and secluded places. Because of this impulse, the child may play truant, or his parents may take to travel.

It is the impulse of *wonder* that is stirred within us when we behold the Grand Canyon, the nebula of Orion, or perhaps a butterfly emerging from its chrysalis. Such things arouse awe or reverence. In this sense, its meaning is quite different from that employed, for example, when we say, "I wonder if it will rain tomorrow." In the latter case, the feeling is not that of wonder, but curiosity instead.

By *gregariousness,* we refer to our interest in other human beings. It is present when so-called "human interest" is aroused.

The term *sympathy* as used here, carries a meaning quite different from the usual one. It refers to our tendency to feel together, whether the emotion is joy, sorrow, or any other. We sometimes say that feeling is contagious, and that interest, which is a specific kind of feeling, is likewise transmitted from one to another by some strange, invisible means. These things are entirely true; and their explanation is found in the tendency of each individual to take from others their feelings or emotions. This tendency, or impulse, is called sympathy.

The impulse of *imitation* is the one that causes young people generally to select, whether secretly or openly, persons whom they admire, and to endeavor consciously to become like them. Thus the youth may choose as his ideal a football coach, a Lindbergh, or

an Edison; if he is normal, it may be safely assumed that there is some person whom he has set up as his model and whom he is endeavoring to imitate.

Altruism is the impulse which makes us desire to help others. We find genuine pleasure in making others happy. In its highest form, this impulse is seen in parents who are devoting themselves to the effort to provide for their children the comforts of life and the best chance of future success and happiness that it is possible to give them. All true teachers likewise have this spirit, as do all or nearly all of our young people in high school and college classes.

The Influence of the Natural Impulses Upon Our Lives

If we attempt to account for the purposes and motives that are witnessed in adults generally we find that they appear to have their origin in the natural impulses. Thus if we think of a typical business man, his interests and motives are seen to arise out of the impulses of ownership, competition, love of approbation, creativeness, altruism with respect to the care of his dependents, and others. In endeavoring to analyze the motives of such a man, we can hardly escape the conviction that all of his large, ruling purposes in life have their source, and likewise their constant driving power, from one or another of the natural impulses. The same is in general true of any other adult. Even the scientific investigator, whose life and thought are supposed to have risen to some higher plane, appears to be as truly and as completely under the sway of these impulses as any other member of our race. They may be love of nature, curiosity, love of approbation

or of prominence, self-advancement, competition, altruism, or other impulses; but, whatever they are, they seem to account fully for the interests that are in him.

In the same way, our children and young people are led by their natural impulses whenever they are allowed to think and act freely. In any given spontaneous activity, it is usually easy to designate the impulses that appear to be at work as was done in the case above; and in every such instance, these impulses seem to furnish a sufficient explanation of the interest exhibited.

We seem warranted, therefore, in concluding that the lives of people generally are ordered by their impulses. Even the drudgery of life, which of course is not interesting, is accepted voluntarily because it is necessary to the realization of those large ends that have grown out of the dominant interests of men and women. In the absence of dominant interests of this kind, such, for example, as those in the rearing of a family, the acquisition of wealth, or other desired ends, the drudgery of life would probably go undone, save perhaps in those regions where slavery still exists.

It is apparently not too much to say that in the impulses we have the original springs from which all interest flows, and that in determining our interests these impulses also determine the particular goals to which we shall devote our lives. Thus what we strive for and, in some large sense, what we become in the midst of our striving depend upon the deep-seated drives, or urges, referred to in this technique as natural impulses.

The Impulses as Guides of Human Endeavor

We may well ask, "Do the impulses guide our lives aright? Are the interests which they generate in us wholesome or destructive?"

In the cases considered above, we saw normal people under the sway of these impulses, yet leading blameless, useful lives. As we study further the manner in which the impulses function, we discover that they have played a vitally important role in the development of our race.

Man was originally, and is yet in a true sense, a child of nature. His first need was adjustment to his natural environment. We find in him an inborn *love of nature*; *curiosity,* which has led him to uncover nature's laws; *wonder,* which arouses in him true appreciation of nature; and *creativeness,* which has given him all but complete mastery of nature. Thus have we come into our interest, our knowledge, our appreciation, and finally our mastery of our natural environment. What could give the necessary adjustment more perfectly than this strange combination of inner impulses? Or could we have subdued the earth without them?

Man is likewise a social creature. His second great need is adjustment to his social, or human environment. We need not be surprised to find that this, too, is provided from within. For by virtue of his gregarious impulse, and impulses of sympathy, imitation, love of approbation and altruism, we find him *interested* in his fellow men, *sharing* in their feelings and emotions, consciously *imitating* those who in his eyes seem worthy, striving to secure the *approval* of

others and disposed to *help or to serve* them. So again we have a group of internal urges whose combined effect is to give him more perfect social adjustment than any that could be devised by himself.

Beyond adjustment to his natural and social environments, he needs some sort of spur to effort. It is necessary that he work, and desirable that he do so willingly. To this end, he is endowed with the impulses of ownership, self-advancement, competition, and love of prominence, all of which give him motive for putting forth his best efforts in the affairs of life.

As we meditate upon these things we may find ourselves lost in wonder that so perfect a plan, and one withal so powerful and unerring in its operation, should have been provided for adjusting us to our world. Education is commonly defined as adjustment to environment. If this definition is accepted, it is for us to note how excellent is nature's system of education, and by how much it surpasses any that has yet been conceived by the mind of man. This is not to disparage the education of our schools and colleges, whose value is unquestionably very great in our scientific age. Yet it only supplements that provided by nature; and in the latter we have the one which operates resistlessly in every normal life, making it to conform more or less closely to the racial mold and to adapt itself properly to both the natural and the social sides of its environment.

From the foregoing it seems clearly to follow that any attempt to involve those impulses, whose function is adjustment, in the work of our schools is to be regarded as wholesome and salutary.

Applying the Suggested Technique

Though the technique for involving the natural impulses in our class work appears to be simple, it nevertheless requires a considerable degree of skill.

The capable teacher finds little difficulty in arousing numerous impulses, frequently seeming to have several active at the same time in the minds of his class. Not all the possibilities of arousing them can be foreseen. Yet this may be done in very many cases if the plan suggested in the technique is carefully followed; and eventually the teacher should become so familiar with the various impulses that he will see, as they arise, a constantly greater number of opportunities for involving them in his class discussions.

A particularly effective method of involving the impulse of sympathy is used by many teachers. At the opening of the class hour, they are careful to exhibit by quality of voice, earnestness of manner, or otherwise, deep, strong interest in the work of the day. Presently, as they see that certain members of the class have caught their feeling, they call upon these students. As the latter respond, their interest is transmitted to others; and thus by careful selection of the first few persons to engage in a given day's discussion, these teachers will spread the interest, which at the beginning was in themselves, throughout the class. This is probably one of the best of all means of securing quickly the interest of any group of students.

Origin of the Impulses Unimportant

The drives, or urges, referred to in the foregoing discussion as natural impulses, may or may not be

inborn. Whether they are a part of the original nature of man seems immaterial from the standpoint of teachers. They are apparently present in all normal persons; and in them the interests of all seem to have their beginning. It follows that the ability to use them skillfully is of utmost value to teachers who desire to control classroom interest in maximum degree. On the other hand, the question of whether they are to be regarded as instinctive, or merely as acquired tendencies, seems to be of small concern to those engaged in actual classroom work.

PROBLEMS FOR THE STUDY HOUR

1. It is often said that unless the teacher is interested in his subject his pupils will not become so. Is there any sound basis for this view?

2. What measure of truth is there in the view sometimes expressed that nature not only demands that we be active but, in general, determines the directions which our activities shall take?

3. In what degree should we endeavor to guide the development of the natural impulses in our students?

4. What natural impulses could be most readily and effectively used in teaching your favorite subject?

5. What relation, if any, exists between the development of the natural impulses in a young person and his moral character?

HELPFUL READINGS

AVERILL: Elements of Educational Psychology, pp. 3–16.
BAGLEY and KEITH: An Introduction to Teaching, pp. 169–179.
PARKER: Methods of Teaching in High Schools, pp. 343–358.
SAXBY: The Education of Behavior, Chap. 3.

RUEDIGER: The Principles of Education, Chap. 15.
BURTON: Supervision and the Improvement of Teaching, pp. 60–64.
MIRICK: Progressive Education, pp. 37–45.
THAYER: Passing of the Recitation, pp. 122–126.
McDOUGALL: Outline of Psychology, Chap. 5.
PRINGLE: Methods with Adolescents, pp. 29–45.

CHAPTER VII

HOW INTERNAL BONDS PRESERVE INTEREST

A CARDINAL feature of all good teaching is that it unfolds its subject in such a manner that every part is bound closely to every other part. Thus the well-taught subject gradually assumes the form of an organized, unified whole, rather than that of a series of more or less unrelated fragments of knowledge.

If a subject is joined together in this manner the interest that is aroused in any part will flow into every other part, pervading the whole. Given many interest centers, such as a skillful teacher is able to create, the entire mass becomes interesting. As a result of this interest, spontaneous thought is induced; and since the parts are so closely bound together, this thought moves with utmost freedom from one part to another of the course. From every standpoint, such a condition is to be regarded as highly desirable.

The bonds, or associations, between the parts of such a course are called in this study *internal connections*. They are an important means of interest control. Almost it seems that the degree of interest in any given course is in proportion to the teacher's care in making them.

The technique given below suggests a number of effective methods for joining closely together the respective parts of any given course.

MAKING INTERNAL CONNECTIONS

Keep internal connections so close that interest will flow with utmost freedom from one part to another of the course. Then spontaneous thought will tend to take the same course. The following specific methods are of much value:

1. At the beginning of any class exercise, see that the new material is quickly and clearly connected with previous work. This is not best done by reiteration by either the teacher or the student. Rather, one of the methods described below may be used:

a. Take up for discussion a question or problem left unfinished, which leads forward naturally into the new problem to be discussed.

b. Add to the conclusion reached in solving the previous problem some new thought or meaning that will lead forward naturally into the problem about to be taken up.

c. Give a short written "quiz" on a single question that will lead the thought of the class from some previous problem to the new one. After papers are taken up, the answer should be given.

d. By a brief, well motivated talk, show a relation that exists between the new problem and other interesting ones that have gone before.

2. Study *sequence* carefully, arranging the problems or topics presented so that each seems to grow naturally out of some preceding one.

3. Make *forward connections,* wherever possible, preferably by handling discussions in such a manner that future problems will arise naturally in the class, and be attempted when met. Such attempted solutions should, if possible, lead in each case to a definite opinion by every student as to the probable answer.

4. In case there is doubt as to whether the class sees clearly the connections of any new topic with others previously studied, see that such connections are made clear. Do not permit the study, even for a short time, of topics that to the minds of the pupils seem actually dissociated from the remainder of the course.

When Teachers Forget the Law

It is readily seen that the law upon which this technique rests is that for the transfer, or spread, of interest stated in Chapter IV. Interest existing in any given topic flows into any other as soon as a connection between the two is seen. Thus if the first topic, let us say, of a course is taught in such a manner as to arouse interest, this interest will flow forward into the second, provided the latter, when it is taught, is seen by the students to bear a close relation to the first. In the same manner, the interest may be carried forward from topic to topic throughout the course.

On the other hand, if there is a loose or broken connection, or bond, between any two topics, the interest can not pass through from one to the other. Thus the living store of interest is lost; and it becomes necessary in such a case to begin anew the work of arousing the interest of our students.

As we contemplate the number of these internal connections which are not clearly seen by students generally, we come to understand one of the first reasons for the common failure of school subjects to command the interest of young people as they should. One of the most frequent, yet tragic, of all mistakes of high school and college instructors is that of teaching topics whose relations to preceding ones are not seen by their

students. As the number of these neglected internal bonds increases, the value of the subject rapidly diminishes. If there are many, it is not too much to say that the subject is virtually worthless, however great the intrinsic value of the subject matter itself may be. This is true because the parts must inevitably break, or fall, apart in the students' minds; and after this the unrelated fragments must as surely fade soon from their memories.

Where Bonds are Weakest in Our Courses

A large proportion of the loose or broken internal connections that are left unrepaired in our school and college courses apparently occur between the daily assignments, rather than within them. That is, the daily units, whether in terms of problems or of topics, may be fairly well organized within themselves in the sense that the parts are carefully related to one another; but between these daily units only the most tenuous bonds, or none at all, may exist. Thus the units stand apart. The condition resembles a chain with each link separate from all the others. Furthermore, it is obvious that the great weakness that is in such a chain exists also in a course so taught.

Methods of Making Internal Bonds Compared

It follows that in teaching any daily unit the first concern of the instructor should be to connect it closely with the preceding units. Yet care must be exercised in this process that it be done, if possible, in a manner that is in itself interesting.

To open the day's discussion, for example, by asking students to repeat what was learned the previous day may serve to connect the new day's work with that of the day before, but may be uninteresting to the class. For the teacher merely to repeat the main points of the previous discussion may be no less so. If he employs either method, he is setting up serious resistance to the desired flow of interest from the previous work into that about to be taken up.

Obviously it is for the teacher to find, if possible, some less objectionable way in which to connect the new work with the old.

The first three plans suggested in the technique enable the teacher to make the desired connection in a manner that is both interesting and effective. Although they do not require that the preceding day's work actually be repeated, they still make it necessary that the students recall it in connection with the new thought process that is initiated. This is the ideal way of joining the new work with what has gone before.

Variations in these three methods can readily be found if they seem desirable. Thus in the case of the first, the teacher may put to the class a question whose answer will add some new thought to that of the previous day. Or instead of giving a bridge question in a "quiz" at the beginning of the hour's work, as is proposed in the third method given, he may have included it in the assignment previously given, thus providing for some thought upon it during the study hour.

Making Bonds That Are Strong

Aside from the special effort that should be made to avoid poor connections between the daily units of

work, much may be done to strengthen the internal bonds of our courses by careful attention to order of arrangement, or sequence.

It is sometimes said that our courses should be presented in psychological, rather than logical order. The distinction may not be entirely clear. Yet there seems in most cases to be a truly natural order of arrangement, by which is meant an order that our minds tend naturally to follow, as distinguished from certain unnatural orders which our minds follow with difficulty.

Probably natural thinking is, in general, cause and effect thinking, and the natural order of thought is from cause to effect or from effect to cause. At any rate, such thinking seems very nearly to supplant all other outside of school. Moreover, in proportion as we introduce cause and effect relationships in our secondary and higher subjects, allowing them to govern the order of presentation, our students apparently find it less difficult to follow the instruction and to master its internal organization.

Following this thought, relationships of comparison, involving merely similarities or differences of any kind, may probably be regarded as unnatural for adolescent and adult minds. Yet all scientific classifications are based upon them; and since most subjects are made up of classified knowledge, it follows that a sequence, unnatural to the minds of our students, is inevitable. Indeed, the so-called logical order, as applied to school subjects, seeks as a rule merely to unfold classifications based upon relationships of comparison, that is, similarities and differences in kind, quality, degree, form, or other properties. Thus the

real distinction between the psychological and the logical order becomes quite clear.

Whether we believe that the natural order of thought is really the order followed in cause and effect thinking or not, there can be no question that we should take great pains to arrange the material in our courses so that each topic or problem will lead into the next in the most natural manner possible. To this end, every internal bond should be most carefully scrutinized; and if even one is found that is tenuous or obscure, we should endeavor to eliminate it by rearrangement of the material.

When we have finished, each topic or problem, save the first and the last, should seem to grow naturally out of the preceding one and to lead as naturally into the next. This rule evidently holds, not merely as to the large, general topics, or divisions of our courses, but as to the relatively small ones making up the daily lessons or discussions as well.

The Mistake of Leading Them Blindly

A significant question having to do with the making of internal connections relates to the direction of the thought at the time that the bonds are formed. Should the minds of our students be "looking forward," or backward? That is, should we see to it that they foresee what is coming, and grasp its relationships to what is already known even before it is reached? Or is it better to keep them in the dark as to what lies ahead, pointing out as each new truth is taken up the relationships of the truth to the things that have been previously studied?

Either plan is entirely feasible. The latter is, of course, the one commonly used. Yet there can be little doubt that the former is far better. Just why this is true is difficult to understand. One can conceive that our minds, like our bodies, look forward naturally, rather than backward. At any rate, it is certain that the young people in our high school and college classes enjoy looking forward in their work and do not enjoy looking backward. Neither do they like very well to be led blindly from topic to topic. Moreover, as they look ahead, in most cases they are already able to see the relationships which the new material that is "on the way" bears to that already studied. Stranger still, the bonds that are formed as they look forward in this manner seem to be stronger and more persistent than those formed by the conventional method.

It follows that we should not, if we can avoid it, wait until the respective problems or topics are taken up, expecting then to make clear their relationships to what has already been studied. Rather, the so-called *forward connection* should be given the preference wherever it can be used.

How Forward Connections May Be Made

Although there are many ways of making forward connections, one of the most effective is to lead the class discussion in such a manner that new problems, known to the teacher to lie ahead of the class, will emerge naturally out of the discussions of those already up for solution. This can, as a rule, be done without difficulty, since the new problem need not be the one to be taken up next but may lie far ahead of where the class is working at the time.

In case a new problem is made to arise in this way out of the one that is up for solution, the class should be allowed to try it at once. The regular problem may be set aside a few minutes for this purpose. However, there should be only a trial solution of the new problem, by which is meant that no final conclusion should be reached. It is enough that each student forms an opinion as suggested in the technique. Then the regular work of the day may be resumed.

The advantages of such a plan are obvious. Since the new problem has come naturally out of one in which they are already interested, and this by a process of their own thinking, an exceedingly close, strong bond is formed between the two. How strong this bond is, is shown by the fact that even though the new problem is dismissed and not taken up for final solution for several weeks, the class will ordinarily recognize it when it is assigned, seize upon it, and see its relationships to other problems without suggestions or help from the teacher. Furthermore, because the problem from which it sprang was interesting, it also will be interesting.

By such forward connections we are able to establish a supplementary or collateral system of internal connections in addition to that arising from our efforts to arrange, in natural sequence, the material we teach. The latter insures a system of bonds directly connecting each problem or topic to the next in the series. The former gives us a system of bonds not ordinarily joining the respective problems to those immediately following but connecting them instead with others encountered later. Thus we shall have two major systems of bonds; and we seem warranted in thinking that

if a given bond of either system should fail, the other would still keep the course from breaking apart at this point.

All of the foregoing means that a well-taught course should give to each student a new *system of thought* in a hitherto unexplored field. This result is accomplished only when the parts are joined, each to each, in a highly skillful manner. In proportion as this new system of thought is built up, the course becomes interesting. If the process is neglected, interest becomes virtually impossible. The making of internal connections is therefore to be regarded as one of the most important of all means of controlling classroom interest.

PROBLEMS FOR STUDY HOUR

1. From the standpoint of internal organization a course may be "an organized, unified whole" or "a series of more or less unrelated fragments of knowledge." Which of these two expressions seems to you to describe with greater accuracy the typical high school or college course? State your reasons carefully.

2. Suppose that a teacher succeeds in creating strong interest in a given problem or topic. How can this interest be used to make *each* succeeding problem or topic interesting in turn until the end of the course is reached? Give examples.

3. Do you believe that one of the four methods given in the technique for connecting the new day's work with that of the preceding day may be applied in every case? Illustrate your answer.

4. Choose a chapter from any textbook in your major subject; make a list of the paragraph headings; and then endeavor to rearrange them more nearly according to the rule for sequence given in the technique.

5. In the list of paragraph headings, or topics, prepared in connection with the preceding problem, find, if possible, one which seems to you to bear so close a relation to some topic occurring in a later chapter as to warrant a forward connection to the later topic when the first one is studied.

HELPFUL READINGS

AVERILL: Elements of Educational Psychology, pp. 180–186.
KLAPPER: College Teaching, pp. 63–66.
PRINGLE: Methods with Adolescents, p. 70.
KILPATRICK: Foundations of Method, Chap. 7.

CHAPTER VIII

AROUSING THE FEELING OF NEED FOR KNOWLEDGE

Of the various plans of securing interest in daily class work, perhaps the simplest and most direct is that of creating in our students the so-called "feeling of need" for the material which they are studying.

It is not difficult to arouse this consciousness of need for knowledge. Obviously, the possibilities in any given case are measured by the future usefulness of the subject matter to the students. If a course contains a large amount of useless material, it is, of course, very difficult to make them feel that they really need it, however hard the teacher may try to do so. But if the material is carefully chosen, the effort to arouse the feeling of need, if properly directed, can hardly fail to result in greatly increased classroom interest.

Several methods are commonly used to make our students conscious of their personal need for the knowledge or ability they are acquiring. It will be observed from the technique below that the most obvious and most frequently applied method is regarded as least effective.

CREATING A FEELING OF NEED

Arouse in the class the feeling of need for the knowledge to be learned or for the skill to be acquired, before either

teaching it or requiring that it be studied. Do not allow pupils to lose this consciousness of actual, personal need for it at any later stage in their study. In endeavoring to accomplish this, make use of one or more of the following plans, which are given in the order of their preference:

1. Use concrete problems of the precise kinds that will actually be met by pupils later in life.

2. Make use of general, abstract situations or problems so typical in character as to arouse the consciousness of inevitable future need.

3. Encourage, or require, the class to discover for itself all possible applications that may be made of the knowledge in future years.

4. By the use of concrete illustrations provided by yourself, keep the students constantly aware of the use that other people commonly make of this knowledge, and also of the probability that similar use will be made of it later by themselves.

How Problems Arouse the Feeling of Need

Nearly all good problems are based upon situations in which knowledge is applied, or used. Moreover, they require that the students actually make the applications of the knowledge involved to the given case. The student who is solving problems is as a rule applying knowledge to specific cases. It is to be expected, therefore, that he will come to see clearly the use and value of knowledge in the affairs of life. Some such consideration doubtless accounts for the fact that the feeling of need seems to be present in all really *good* problem work.

It is still true, however, that problems may or may not arouse the feeling of need. Fanciful and unreal problems seem to lack this power. In proportion as

they are made real, rather than imaginary and artificial, they become more potent to create the consciousness of need. Yet this alone is still insufficient. It is necessary that they be, as the technique puts it, "problems of the *precise* kinds that will actually be met by the pupils later in life."

Whether such problems can really be provided will be considered later. The essential point is that they have some strange quality that enables them to generate the much-desired feeling of need quite independently of any effort on the part of the teacher. Given problems of this kind, the young people seem to sense their truthful character and to project themselves into the situations described. There can hardly be any question that the use of problems of this particular type is entitled to first place among all known means of arousing the feeling of need.

Abstract Problems That Are Effective

Whereas concrete problems of the specific kind described above are generally to be preferred, it is still true that certain abstract problems have power to arouse the feeling of need in a remarkable degree. They are apparently those which represent typical, rather than, let us say, exceptional or unusual situations. A general or abstract problem of any kind dealing with a situation or difficulty that is rarely met seems to be unconsciously classified by the students along with the unreal and imaginary concrete problems referred to above. On the other hand, if the situation involved is one commonly met, it seems to be nearly as potent to create the feeling of need as are concrete problems of the type described above. It is

not true at all, as is often held, that only concrete problems can induce in students a consciousness of genuine personal need for knowledge. Rather, a well-chosen abstract problem is easily to be preferred, in this respect, to one that is concrete, but that involves a situation which will probably not be met by many members of the class.

Methods Involving Direct Effort

Obviously a highly effective method of arousing the feeling of need is that of having students search out, as suggested in the technique, the practical applications, or uses, that are made in the outside world of the knowledge which they are acquiring. Here, again, much depends upon whether the applications found seem to be common or rare in life. If the former, the conviction will come to the students that they truly need the knowledge they are acquiring.

Finally, the teacher himself may by frequent references to the varied uses outside of school of the knowledge that is being presented keep his students alive to their future need for it. Very many skillful instructors depend upon this method almost exclusively in trying to arouse the feeling of need. It is open to the objection that students often learn to discount the statements of the teacher, who in his enthusiasm appears at times to magnify the value of his wares.

Through the foregoing runs the implication that our students can not easily be deceived as to the value of the knowledge that is being studied. This seems literally true. Yet it is true also that they may become oblivious to the whole question of future need even though the knowledge is really valuable; and as a

result very much knowledge is apparently taken in by them without any understanding or thought of its probable value or use in later life. Rather than this, they should, of course, be led to see the value that is really in it, whether the methods employed are good or poor, and whether this value is great or small. The cardinal mistake is to allow them to acquire knowledge without sensing its value, or seeing the use that they will have for it at some later time.

PROBLEMS FOR STUDY HOUR

1. How would you account for the fact that "problems of the precise kinds that will actually be met by the pupils in later life" seem to arouse in them the feeling of need for the knowledge that is involved without any effort on the part of the teacher?

2. Do you agree with the implication of the technique that it is better to have the students search out the practical applications of the knowledge which they are acquiring than to tell them what these applications are?

3. Assuming that your pupils were equally able to solve a given problem in concrete, or in abstract form, which would you prefer to have them do?

4. It is held by some that a chief reason why many students dislike mathematics is that too large a proportion of the problems are artificial and unreal and therefore fail to develop the feeling of need. Do you believe that this criticism is justified as to algebra and geometry?

5. Do you believe that teachers should give more careful study to the applications that are made of their respective subjects outside of school than they ordinarily do?

HELPFUL READINGS

CHARTERS: Methods of Teaching, pp. 158–165.
DEWEY: Interest and Effort in Education, pp. 46–63.

CHAPTER IX

SUSPENSE AS A MEANS OF INTEREST CONTROL

A METHOD for the control of classroom interest which seems to have escaped the notice of many teachers is that suggested in the heading above.

Suspense appears to be among the most powerful of all stimuli of thought. If it is once established, thinking results automatically; and when it ends, thinking apparently ceases abruptly. Suspense is the chief reliance of the dramatist and story writer, both of whom are extremely careful to preserve it until the very end is reached. How effective it is in the control of interest is seen in the profound spell which a really good novel or drama can throw around the average person irrespective of his training, experience, or intelligence.

It can apparently be used with nearly as great effect by teachers as by others. Neither is the technique difficult, provided the classwork is actually upon a thought basis. It is given briefly below:

CREATING AND MAINTAINING SUSPENSE

Bring about as quickly as possible in every class discussion a state of suspense as to the outcome. The most effective rules for the attainment of this end appear to be as follows:

1. Create *doubt* as to the right answer of the problem under discussion. This may be done by calling for other

answers unless the class is unanimous in the view that the one given is correct. In such case, put questions to the group which seem to suggest or point toward another possible conclusion; or express such a conclusion, supporting it strongly enough to make it appear plausible.

2. After doubt has been established in this manner, maintain it by keeping the opposing conclusions evenly balanced with respect to the evidence cited in their support. To this end, aid the weaker side or attack the stronger as may be necessary.

3. Do not allow this doubt to be dispelled by any word, facial expression, or quality of voice that will betray what you know or believe the right answer to be.

Suspense Not in Accord with Old Ideas

A glance at this technique is sufficient to show the great difference that exists between the method which it suggests and those generally used in the past.

Wrong answers, for example, have long called for expressions of the teacher's disapproval. Indeed, it has even been thought proper to make those pupils who gave such answers as uncomfortable as possible. Yet here it is proposed that the teacher shall search for wrong answers to put against the right ones, or even go so far as to suggest conclusions that he knows to be incorrect.

It has apparently been felt that the teacher who would seem in any way to approve, or who would even permit, the expression of wrong answers in his classes thereby committed some sort of moral wrong. Aside from this, there are many who believe that if pupils are allowed to see or hear more than one answer they are as liable to remember the wrong ones as the right ones.

Why Suspense Is Still to Be Desired

Against these views run two nearly unanswerable arguments. We shall never teach our students to think well as long as we allow them to see but one side of the respective questions that are raised. In seeing both sides, or all sides, and in weighing carefully the evidence for one against the evidence for another, lies the very essence of good thinking. The second consideration is that after a student has expressed a wrong conclusion and has defended it, but has finally seen just why it was wrong, he will *not* soon forget the right one. It is not a mere matter of remembering what he has seen or heard. Instead, he will know the right answer because he understands why it is right and why others are wrong. These considerations may not, of course, hold in the case of small children studying the "tool subjects"; but they seem to be valid, however viewed, with respect to the learning of high school and college students.

Establishing the Desired State of Doubt

The essential condition of suspense is doubt, or uncertainty. It follows that for the teacher simply to say a given answer is wrong will not create suspense at all, since doubt would be dispelled rather than created. When students have learned on the high authority of the teacher that the thing which they thought was right was really wrong instead, their certainty is even greater than it was before. It is required not that we destroy their beliefs, but that we put others in competition with them.

Manifestly there are two ways of doing this. We may call for all conclusions that have been reached by members of the class before allowing any discussion to start. Thus we shall probably be able to set up two or more competing answers at the beginning. If only one is found, however, we must turn our attention to the matter of its validity or soundness; and even though the entire class may say that it is right, we may usually by some such methods as are suggested in the technique quickly establish the desired state of doubt and uncertainty in their minds.

Preserving the State of Suspense

'All teachers who have developed genuine skill in applying the technique above will say that suspense is even harder to hold than to secure. The difficulty doubtless arises from the fact that the teacher knows so well the answer to which the discussion must finally lead that only by the utmost care can he avoid revealing it unintentionally.

Aside from the danger that he may disclose the answer unawares, however, there is another that the argument may becomes one-sided is spite of his best efforts to prevent it. How serious this really is, is seen in the case of a football or tennis game, let us say, in which the score is not at all even. In general, suspense vanishes as the gap widens between the scores. On the other hand, if the scores remain nearly even, no matter how large or small they may be, suspense remains high to the end.

The important principle illustrated above is applied in our class work by seeing to it that the evidence pre-

sented for any given conclusion does not greatly outweigh that offered in support of any other. To this end the teacher may properly resort to the plan of calling upon the stronger advocates of the weak or incorrect views and opinions, and the weaker exponents of the things that are right. Or he may, as suggested in the technique, even help those who find the argument going against them, or perhaps put questions whose purpose is to bring to light weaknesses in the argument that seems to be forging ahead.

When the State of Suspense Should End

Of course, a class discussion of this kind cannot go on indefinitely. Neither should it be prolonged unnecessarily. Yet it must not be forgotten that the various reasons given in support of one or another of the opposing views constitute so many facts having an apparent relation to the question at issue, or that those facts are being weighed by the respective members of the class as they are presented. This is the type of thinking that our students should be taught to do. Yet when the facts are in and when a reasonable amount of time has been allowed for the weighing process, it is entirely proper to allow those who are standing for the view that is right to present the final evidence that will win the case.

Often no such massing of evidence at the end is necessary, owing to the fact that those who were originally upholding wrong opinions have already seen their mistakes and relinquished their views. Indeed, one of the most interesting and inspiring sights witnessed in the classroom is that of a group of minds,

originally in disagreement, arriving at a common conclusion as soon as all have come into possession of the same facts. To see many minds starting in this manner from many different points and coming unerringly to the same one in the end, can hardly fail to quicken our faith in human intelligence.

PROBLEMS FOR STUDY HOUR

1. Would the instructor who is engaged in teaching facts as such probably find it easy or difficult to apply the technique for suspense given in this chapter?

2. Do you approve of the traditional method of teaching, in which high school and college students generally have been expected to study only one side of the various questions raised, together with the evidence supporting that side?

3. Suppose that in leading a class discussion you find that the state of suspense is about to come to an end because the argument has become one-sided. What would you do?

4. How much weight should be given to the criticism sometimes heard that those teachers who try to make their work interesting are teaching mere entertainment courses.

CHAPTER X

DEVELOPING INTERESTS THAT WILL ENDURE

THE transcendent interest skill is that of building strong, lasting interests in the minds of our young people.

The ability to secure and hold interest in his daily classroom work is very valuable indeed to any teacher; yet it is relatively unimportant when considered beside genuine skill in developing in his students the interests that are to determine what they will think about, what they will do, and what they will become after their school days are over. With this, hardly any other teaching skill may be compared.

Permanent interests can not be built up quickly. Rather, they require painstaking care and long-continued effort. Not all the laws that govern their development are known. We are able, however, to accomplish the desired end at least in part through the principles and laws which we are able to apply; and after this it must be left to each teacher to give of his own store of interest or to devise such other ways and means as may be necessary to make the work complete.

In the following technique an attempt is made to present an effective procedure for the development of enduring interests in high school and college students.

THE DEVELOPMENT OF PERMANENT INTEREST

Beginning with the first meeting of the class, give careful attention to the development, in the students, of enduring interest in the subject or course that they are taking up. In general, avoid any consideration of its informational content until a considerable degree of interest has been aroused. After this, endeavor without ceasing to strengthen interest in the course as a whole. In the attempt to develop such interest in any given course, make all possible use of the methods described below:

1. Early in the course, endeavor through general class discussions, rather than by mere telling, to lead the students to see clearly just how the subject which they are taking up may be expected to prove useful to them in later life and *how great* its actual value to them will probably be.

2. At the same time, attempt to establish clearly in their minds the *relationships* that exist between the new subject, taken as a whole, and any other branches of knowledge, or human activities, in which they are *already interested.*

3. Specify and describe the new, worth-while powers and abilities which are to be acquired from the course, endeavoring to create in the students the strongest possible *desire* or "feeling of need" for them.

4. When initial interest has been developed, proceed to the study of the content of the course. At every stage of this study, keep interest in the daily work at the *highest possible pitch* by diligent use of the six techniques given in the preceding chapters for the control of classroom interest.

5. As the first step in the development of each new ability or skill, attempt to establish in the minds of the students the *ideal* or *high standard* which they should endeavor to attain. Make this ideal as strong as possible since it is the incentive to voluntary effort. Avoid any attempt to develop abilities in the absence of such ideals.

6. Develop as far as possible the *actual skills* or abilities, whereby the newly accepted ideals may be in some degree attained. Whether these skills are manual or intellectual, make their development a major part of the course.

7. Handle the course in such a manner that the class will have a sense of *constant progress* in the acquisition of new knowledge and in the development of new skills, abilities and powers.

8. Throughout the course, endeavor to make many connections forward to interesting problems and applications that will be met later. Some of these forward *connections* should be left still "open" when the end of the course is reached.

The Two Phases of Interest Building

An examination of the foregoing technique makes it clear that there are two important phases of the interest-building process.

In the earliest stages, the teacher's efforts should be directed toward generating, or bringing into existence, new interests, that is, interests which he wishes his students to acquire from the course *as a whole.* The creation of these initial interests is the work of the first days of the course. The first three methods given in the technique are particularly helpful at this stage.

After initial interest has been created, the teacher's task becomes that of keeping it growing. The last five rules of the technique are of greatest value in connection with this phase of the process.

The Interest Approach

The early attempt to create interest in the course as a whole, usually by the use of the three methods first

described, is often referred to as the interest approach. It should be planned with the utmost care, the methods given not being used in simple succession but in the most effective combination that the teacher is able to devise.

The forward look suggested first in the technique to determine in what ways the course about to be taken up may be expected to prove useful in the future, and how great its value will probably be to the members of the class in later life, should be most carefully handled. If they become convinced at this early point that the course will be of genuine value to them later, a long step will have been taken in the development of the desired interest. On the other hand, an impression gained at this point that the values claimed for the course are largely imaginary and exist chiefly in the teacher's mind will render subsequent efforts of any kind nearly futile.

Hardly less important in connection with the attempt to lay a first hold upon the students' interest is the plan of leading them to see the relationships existing between the new course, or subject, *as a whole* and other things in which they are already interested. Here the teacher is, of course, really making external connections; yet it should be noticed in this case that the connections established are between relatively large things. That is, the entire subject, or course, is related to other large subjects, fields of knowledge, activities or occupations in which the students already have genuine interest. This tracing out of relationships between the new subject, in the large, and other things which seem important and interesting to the young people requires again most careful planning on

the part of the teacher. If this planning is done well, it must inevitably bring a real wave of interest into the new subject.

In this preliminary study of the character of the subject that is being taken up it is a matter of the highest importance that the students be led to see clearly the worthwhile new *abilities, or skills,* that they are to acquire in connection with the course and to consider the value or usefulness of these abilities to themselves in the future. They should not be presented in the form of a long list of relatively unimportant new skills, but rather as a smaller number of abilities that will seem to them large, important and really desirable. This statement carries the broad implication that every subject should actually give to the young people *valuable skills,* abilities and powers that they have not previously possessed. It must apparently be accepted as to virtually all courses; and it follows that among the very first steps in the effort to develop permanent interest is the organization of our courses so that they will actually *yield such abilities* or powers rather than mere accumulations of information.

New Abilities as Sources of Interest

Young people may not always be found hungering and thirsting after knowledge, but they, like their elders, are keenly interested in the acquisition of new powers, abilities and skills. The desire to know is not innate, but the desire to acquire new powers appears to be so. Even little children are interested in becoming able to do things that they could not do before.

In their simple, childish accomplishments they take genuine pride. As they grow older their desire for new powers and abilities seems to increase. Indeed it appears to be a sort of basis, or measure, of their own self-esteem. The so-called inferiority complex is apparently found as a rule in those who have become convinced that there is nothing that they can do as well as others.

It is true, of course, that young people do not desire all abilities with equal fervor. Yet once they are persuaded that a given ability or skill is worth while in the sense that it will prove truly valuable to them later, they immediately become interested in its acquisition. This deep-seated desire for new powers and skills is unquestionably one of the most potent of all stimuli of sustained interest and effort.

Daily Interest a Condition of Permanent Interest

Coming now to the point at which the work of strengthening, or nurturing, the new-born interest must be taken up, let us observe that its very first condition is sustained interest on the part of the students in the daily class work. It follows then that the classroom interest skills presented in previous chapters must play an essential part in the effort to develop permanent interest.

There is a sound reason why classroom interest, if held at a high pitch, as required by the technique, may ripen into that which is more powerful and enduring.

Let us suppose that a given problem or topic, say the first one in the course, has been made really interesting by the use of natural impulses, external con-

nections, or otherwise, and that the second topic, or problem, has been clearly connected to this one when subsequently introduced. We should have then the interest that was aroused in the first problem flowing over into the second in the manner explained in Chapter VII.[1] But suppose now that the same process is repeated in handling this problem as was used with the first. It would receive, in addition to the inflow of interest from the first problem, an accretion, or increment, of interest of its own, whether from natural impulses or other sources; and so the store of interest finally passing on from it to the third topic or problem of the course, provided a close connection is again made, would be greater than that received by it from the first. Thus each problem would pick up new interest from various outside sources, adding it to the store received from the preceding one, and pass the entire amount on to the next. It follows that the accumulated store would become larger and larger even to the point at which, because of its magnitude and power, it would mature into the form referred to here as permanent interest.

The Role of Ideals in Interest Building

If we consider any given skill, we observe that its true starting point is an ideal, and that the skill itself merely represents some high degree of proficiency in the attainment of this ideal. The musician, the window dresser, the surgeon in performing an operation, the housewife in baking cookies or the milliner in trimming a hat is endeavoring to attain an ideal of some

[1] See page 55.

kind. Unless some ideal is actually present in any given case it is safe to say that superior skill will not be exhibited. The ideal may not be attained, and in general never is. But it must exist; and the degree of skill developed depends entirely upon how nearly the actual achievement approaches it.

We should notice further, however, that an ideal, once accepted, becomes itself a *new center of interest.* That is, an ideal represents a goal which one wishes so strongly to attain that he is willing to put forth genuine effort to this end. He must therefore be truly interested in it; and anything that is related to it in any way acquires interest as a result.

These considerations make clear the reasons for the fifth step suggested in the technique. But there is still another to be noted. It is that all teaching is futile if our pupils have not first accepted the ideals which we are trying to make them able to attain. They must desire to achieve the goals that lie ahead in their respective studies. Otherwise, nothing can be accomplished for them by the teacher. This is true whether these goals are the acquisition of specific abilities or of particular kinds of knowledge. An example of a truly wasted life is seen in that of an instructor whose time is spent in teaching to pupils knowledge and abilities which they do not care to possess.

How Ideals Are Satisfied

An ideal is an internal demand for achievement. It calls for the actual development of skill. When it has once been established, there is no way to satisfy

it but to endeavor to achieve the desired goal. That is to say, it is for us who teach actually to *develop* in our students, as the technique proposes, the new abilities and skills which they have come to desire. If we do not do this, then the creating of the feeling of need and the subsequent setting up of the ideals, as suggested in the previous steps of the technique, will prove of no avail. The satisfaction of the ideal lies in the achievement of the desired ends, that is, in the actual acquisition by the students of the desired skills and abilities. Moreover, this rule clearly holds with respect to the intellectual skills, just as it does with those that are manual or physical in character.

The foregoing implies a truth that may not at first be discerned. Not only must abilities in some degree be acquired, but there must be, on the part of the students, a feeling of constant progress in this acquisition, else their interest will presently be found waning. Just as the feeling that skill is really coming to them strengthens their interest, so the feeling that it is not increasing tends to destroy interest. There can be little question that the "sense of progress" referred to in the technique is in the highest degree essential to the development of permanent interest.

Efficacy of Forward Connections Left Open

The final rule of our technique is that many forward connections be made and left open at the end of the course.

From the standpoint of permanent interest, these "forward connections left open" seem to play a vital part in our work. Each one represents in a true sense

a look ahead into some new field toward which the course is leading. In proportion as such connections are made, the young people will come to realize that more lies beyond that is truly interesting and worth while. Thus their eagerness to go on into the new fields will be increased. It follows that this rule should be increasingly applied as our classes near the end of their respective courses.

The value of forward connections as a means of knitting a given course together internally was considered in Chapter VII. The forward connection that is left open at the end of the course serves to join courses to one another. Its importance can hardly be overestimated in education, since the organization of one's entire system of knowledge into a unified whole is necessary alike to its retention and subsequent use. Furthermore, it is an end that is often missed in school work, owing to the fact that knowledge is ordinarily found by students in "air-tight compartments" having no apparent relationships to one another.

PROBLEMS FOR STUDY HOUR

1. It is held by some that in proportion as we keep our young people interested in their studies they may be expected to become weak students and eventually men and women of weak wills and weak characters. Do you agree with this view?

2. How do you account for the fact that so few students acquire strong, permanent interests in the subjects which they study in high school and college?

3. A teacher of physics in meeting for the first time a class which had little apparent interest in the subject began by stating that physics is the science of matter and energy and fol-

CHAPTER XI

THE RELATION OF THINKING TO HUMAN ACHIEVEMENT

In the preceding chapters were considered the problems of how to control classroom interest and how to develop or build strong lasting interests in young people. This study has been made for the reason that interest, as shown in Chapter II, appears to be one of the three necessary conditions of retention of knowledge by the human mind.[1]

How the teacher may similarly control the other two remains yet to be considered. They are *understanding* and *subsequent use in thinking.* Both of these involve thinking and can therefore be brought about by the skillful guidance or direction of the thought processes of our students. This guidance doubtless represents the highest function that the teacher is called upon to perform. Moreover, it is the most difficult function because so little is certainly known about reflective, rational thinking.

The Role of Thinking in Human Affairs

Man seems to differ from other creatures mainly in his ability to think better than they. By this advantage, apparently, he has attained dominion over them.

[1] See page 12.

An even more significant fact, and one that is less obvious by far, is that, as he has risen in the scale of life, it has become necessary for him to do constantly better thinking. We who live in the modern, complex world must necessarily "use our heads" more and perhaps depend less upon our physical powers than did our ancestors who lived their simple, primitive lives among the wild things of nature. Not only is civilized man a more thoughtful creature than his prehistoric forebears, but it may even be truthfully said that in nearly every walk of civilized life, those individuals are most efficient and successful who are the best thinkers. Whether we consider the business man, the physician, the mother in the home, the craftsman, the farmer, the miner, or any other, we find in the work and life of each the need for clear, accurate thinking; and as we reflect further we see that this intellectual factor is the one upon which success or failure in their lives seems mainly to turn. The only persons of whom this may not be true are those who are engaged in certain purely manual pursuits. In other fields generally, those push ahead and are most successful in the end who are able to *think better than their fellows.*

Even the foregoing does not reveal the whole truth as to the importance of thinking to civilized man. Not only does it enable him to overcome the manifold difficulties which confront him as an individual, but it offers the sole means by which he, in common with all others of his race, may eventually escape from the universal ills to which human flesh has thus far been heir. In no other way can he liberate himself from disease, crime, vice, war, sin and other like afflictions.

Yet we are coming now to see that when he has really learned to think well, the whole hateful brood of evils that now beset him may be expected to pass out of his life forever. As his gradually developing ability to think has brought him far on his upward way, so it will doubtless bring him at last to the goals which now seem to him remote and all but unattainable.

The Thinking That Life Calls For

Once we have discerned clearly the vital importance of sound thinking in human affairs, we may well ask, What kind or kinds of thinking are of most worth to people generally? What kinds really determine their success or failure in life? What sorts of thinking are most commonly done by them outside of school? What kinds are we teaching our young people in school to do and how well are we teaching them to do it? Are we training them for the thinking that they will really do in the future? Or are we instead teaching them to do only that which their "lessons" happen to require without regard for that demanded by later life?

As we recall the fact that there are three general types of thinking which are *intrinsically interesting* to the human mind,[1] we may easily infer that these are the kinds which people would generally be found doing in connection with the ordinary activities of life. This is apparently true; for all, or very nearly all, of the thinking that is done outside of school seems to be directed to one of three ends. It is performed (1) to determine or discover an unknown fact or truth; (2)

[1] See page 36.

to reach a decision or conclusion through judgment or reasoning; or (3) to devise or work out a plan whereby some desired end may be accomplished.

To illustrate, let us consider some of the specific problems which people meet in connection with the common affairs of life outside the school.

A man may wish, for example, to know whether a certain new model of car, which he contemplates purchasing, will prove durable under severe use; whether his competitor is planning to add a new department to his store; whether business conditions will be good or poor during the next year; whether his wife is expecting a new rug for Christmas; or where he left the umbrella with which he started from home in the morning. To each of these questions, or problems, as it comes up, he will devote his best thought, considering such facts as he may have at hand that seem to have a bearing upon it. In every case he is endeavoring to discover or determine *an unknown fact or truth.* Moreover, the problems are in every respect typical of a great multitude which are encountered by people of all ages and occupations in connection with the affairs of everyday life.

Problems requiring a decision, or choice, reached through *judgment* are likewise commonly met. We may, for example, see parents trying to decide whether or not to send a son to college; a housewife choosing between two grades of gingham for an apron; a teacher endeavoring to decide whether or not to give a student a passing grade; a business man perplexed to know whether to invest his savings in bonds or the stock of a manufacturing concern; or a child trying to decide whether to spend his nickel for an ice cream

cone or for chewing gum. All of these are representative of a great class of problems that seem to come in ceaseless succession to old and young alike. All call for a decision, or choice, between two or more alternatives. They may be momentous or inconsequential in character. As some judgment problems relate to matters of really trifling importance, so many others lead to decisions involving the most tragic consequences.

We should distinguish clearly between the judgment process illustrated in the above problems and the reasoning process as the two terms are used here. The former is characterized by the fact that the conclusion reached is believed to be correct but cannot actually be proved so. It is a process in which facts are carefully weighed and a decision arrived at which they seem to warrant or justify. Given the same facts, different persons may arrive at different conclusions. Yet judgment is in no sense "guess work;" and, with the same facts given, persons of sound judgment will tend strongly to agree. With these things in mind, the distinction between judgment and reasoning is easily seen. The process of true reasoning, as the term is here used, leads to a conclusion that is capable of *proof,* or *verification,* and is therefore known to be certainly correct. This is, of course, characteristic of all mathematical thinking; and in mathematics we have the best of all examples of the true reasoning process. The process is also seen in some of the physical sciences and in certain of their applied forms, like mechanics or the various forms of engineering.

Reasoning problems, then, are met, let us say as illustrations, by mechanics in locating troubles and ad-

justing their machinery; by builders in calculating materials and cutting parts to fit; by accountants in determining the conditions of concerns under examination; by sales people in computing the total amount of each successive bill of goods sold, or by purchasers who "check" upon the process; and by others in certain specialized occupations involving quantitative calculations, like engineers or technicians.

Finally, *creative* problems are frequently met by nearly all persons in the ordinary round of daily life. All people, whether old or young, do more or less *planning* in connection with their everyday affairs. A creative problem is merely one which calls for the making of a plan of some kind, whether the latter is for the accomplishment of a great purpose or a trivial one. Thus the mother who is endeavoring to plan her morning's work so that it will be finished in time for lunch; the youth who is trying to devise a way to gain the affections of the maiden of his choice; the high school girl evolving her best plan for winning a declamatory or beauty contest; and the boy who is trying to design and make a kite that will fly better than those of his companions are all engaged in the solution of genuine creative problems. The common impression that only artists, poets, inventors and the like perform true creative thinking is very far indeed from the truth. Rather, it seems that nearly all of life's duties, save those which are reduced to the dead, mechanical level of habit, call for some measure of planning. Since every such situation, however commonplace, constitutes a true creative problem, it is easily seen that the lives of all normal people are filled with them.

What Thinking Is Most Valuable to Us?

Of the various types of thinking that are performed by the average person outside of school, what ones really contribute most to his efficiency and consequent success in life?

At first, we might be inclined to believe that the one which would most nearly determine his efficiency is reasoning since it is the only one leading to results that are exact and known to be correct. However, there is so little of it in life at large, in comparison with other kinds of thinking, that such a conclusion seems quite unwarranted. This does not mean that true reasoning is lacking in intrinsic value to the human race. That would be very far indeed from the truth. It is by virtue of the accuracy of reasoning that man has been able to apply the forces of nature to the achievement of his purposes with the wondrous degree of precision that is observed on every hand. We may well wish for the day when reasoning will supplant other thinking generally. Yet it will probably not arrive soon, owing to the fact that so few of the forces with which humanity has to deal are as yet measurable. This is, in general, true of those which are biological or social in character; and, in general, it is only when forces have been measured and may be quantitatively applied that they ordinarily enter into that type of thinking referred to herein as true reasoning.

It is still true that in other thinking reasoning elements are found. Whereas the process as a whole may be in any given case, let us say, one of judgment or creative thinking, certain of the data used may yet be, and frequently are, quantitative and exact.

Although problems of the reasoning type play a rather important part in the life of the average person, those involving judgment are unquestionably of greater importance still. As has been said, such problems are constantly met; and upon their solutions often hang the most momentous outcomes. While there is no way of knowing, at the time they are solved, whether the conclusions reached are really correct, time nearly always answers this question. By the answers thus registered we come to know the person of good judgment from the one whose judgment is poor. However, the reward of superior judgment is something more than the good opinion of one's neighbors. The man who has it is, as a rule, more successful in his undertakings than others. He seems to avoid the mistakes that they make, to foresee the difficulties that others meet unawares, and to be prepared for them when they are encountered. There can be little doubt that in sound judgment we have one of the very first factors of human efficiency and success.

Though we recognize fully the vital importance of judgment as a determinant of human success and achievement, we are still unable to say whether its value is greater or less from this standpoint than that of creative thinking. The latter, too, is exceedingly common, as has been already shown. Moreover, the ability to plan well seems to have nearly as great an influence upon human achievement as does superior judgment. In general, it may be truly said that those who plan best get along best and accomplish most in life. In this industrial age, the greatest of all financial rewards go to those who are able to lay the soundest plans for the management of great business enter-

prises. Yet it is equally true in the humble walks of life that by the ability to plan better than others, men and women attain success. As between judgment and creative thinking, it is indeed hard to say which operates more powerfully to carry men on to the goals they desire to attain. Perhaps we should merely say instead that these are the two which, taken together, virtually determine human achievement and efficiency in practically every field of human endeavor; and we should note further that the two are usually found together in the sense that the person who has one in high degree is liable to possess the other also.

It is quite difficult to evaluate the remaining type of thinking, which has for its purpose the discovery of unknown facts or truths. Such thinking always consists of either reasoning or judgment processes. Because of this, it should probably be regarded as falling into one or the other of these two classes. Since this has been done in the foregoing paragraphs, it appears unnecessary to consider it further.

Does the School Train Properly for Thinking?

To those who read thoughtfully, it must have become already apparent that the training in thinking given by the school is *not* that which is called for in the world of affairs.

Nearly the only effective training in thinking that is given by our schools is that in true reasoning which is provided by mathematics and the physical sciences. Yet this, as has been seen, is the type of thinking that seems to be least used in life. Apparently there is little serious effort to give training in judgment or

creative thinking. Indeed, we may say that almost no thinking of either type, that is actually adjusted to the ability of the students and held up by the teacher to the true standards of really sound thinking, is provided by the conventional high school or college. Only here and there do we find work calling for these types of thought; and the thinking required even in these cases is so inferior in quality that we should probably be justified in dismissing it as of very little value. The vocational subjects seem to offer about the only exceptions to this rule. They may be, and occasionally are, taught in such a manner as to result in thinking of the desired kinds.

Whether the conventional school subjects can really be made to furnish worth-while training in thinking other than reasoning will not be considered here. At this point we need only to recognize the somewhat sinister fact that our schools provide hardly any training for those types of thinking which unquestionably mean most to the efficiency of men and women living in the present complex age.

PROBLEMS FOR STUDY HOUR

1. Which seems to you of greater value to a teacher, skill in the control of interest, or skill in the direction of the thought of his students?

2. In what specific ways has man's ability to think contributed to his present dominion over other living things?

3. How do you account for the apparent fact that physical strength and prowess are of less importance in modern civilized life than in the life of primitive peoples generally?

4. Name the six persons whom you regard as most able and successful in American public and industrial life at

present and state to what extent the success of each seems to have been due to his superior thinking ability.

5. Should the schools of America be held responsible for developing in the children of the nation the ability to think well?

6. What explanation, if any, can you offer for the fact that our schools give so little training in judgment and creative thinking?

7. Can mankind, by good thinking, finally rid itself of the many ills which have beset the race throughout its past?

HELPFUL READINGS

DEWEY: How We Think, pp. 14–20.
DEWEY: How We Think, pp. 101–115.
BORAAS: Teaching to Think, Chap. 1.
DEWEY: Democracy and Education, Chap. 11.
KILPATRICK: Education for a Changing Civilization, pp. 53–68.
Columbia Associates in Philosophy: Introduction to Reflective Thinking, pp. 1–15.

CHAPTER XII

THE TRAINING OUR YOUTH SHOULD HAVE

In the preceding chapter the assertion was made that the school is not really doing what it should with respect to training our young people for thinking. The statement did not take into account, however, the possibility that the training given for reasoning, such as that offered by mathematics or physics, may also develop as a by-product true skill in judgment and creative thinking.

May it not be true that by training a student, let us say in mathematical reasoning, we shall make him sound also in judgment and resourceful in original planning, or creative thinking?

This belief is current apparently because of the common observation that persons who have been proficient in mathematics in high school or college are frequently found skillful in judgment in later life. Despite this fact, the opinion seems hardly justified since skill in reasoning, in judgment and in creative thinking may all be traced back to the same simple *first* cause, namely, the possession of a good mind. That is, a good mind, merely because it *is good*, may be able to do reasoning, judgment thinking and creative thinking equally well. Hence it would be clearly improper, then, to ascribe development in the latter two to training in the first. This is not to say that mathematical

training can not bring about improvement in judgment or creative thinking, but merely that the evidence considered above, which is very frequently cited, is far from acceptable.

Let us, with the question still open, notice in what respects *true reasoning differs from judgment and* creative thinking.

A Comparison of the Three Types of Thinking

In *reasoning,* as the term is here used, we proceed by successive steps, each of which is known to be certainly true, to a conclusion which is likewise known to be true. This *certainty of the correctness* of the conclusion is the essential characteristic of the true reasoning process. However, the *succession of steps,* each of which leads nearer to the final goal, and none of which may be omitted, questioned, or denied, since all are incontrovertible and necessary, is likewise characteristic of the process.

In *judgment,* we seem to have an entirely different procedure. Here we start with a limited number of facts, and in the light of these form an opinion, or inference. Following this we compare our inference with other facts, one by one, to see whether it is in accord, or in conflict, with them. Thus it is "checked" against each fact in turn. And if even one is found with which it is not in harmony, the inference is usually revised as may be necessary to bring it into accord with the given fact; or if this is impossible the inference may be relinquished altogether. If in this manner an inference is finally evolved which is in harmony with all the available facts, it is accepted as

probably true and becomes the final conclusion. Or if no inference can be found that is consistent with all the facts, we usually decide the matter upon the basis of the "preponderance of evidence." That is, we accept the view supported by that group of facts which, in the aggregate, seems to us to outweigh any other group. An interesting description of the process by Benjamin Franklin, who endeavored to simplify it and, if possible, to increase its accuracy, is as follows:

"When those difficult cases occur, they are difficult, chiefly because, while we have them under consideration, all the reasons pro and con are not present to the mind at the same time; but sometimes one set present themselves, and at other times another, the first being out of sight. Hence the various purposes or inclinations that alternately prevail, and the uncertainty that perplexes us.

"To get over this, my way is, to divide half a sheet of paper by a line into two columns; writing over the one pro and the other con; then during three or four days' consideration, I put down under the different heads short hints of the different motives, that at different times occur to me, for or against the measure. When I have thus got them all together in one view, I endeavor to estimate their respective weights; and, where I find two (one on each side) that seem equal, I strike them both out. If I find a reason pro equal to some two reasons con, I strike out the three. If I judge some two reasons con equal to some three reasons pro, I strike out the five; and thus proceeding I find at length where the balance lies; and if, after a day or two of further consideration, nothing new that is of importance occurs on either side, I come to a determination accordingly. And, though the weight of reasons can not be taken with the precision of algebraic quantities, yet, when each is thus considered separately and comparatively, and the whole lies before me, I think I can

judge better, and am less liable to make a rash step; and in fact I have found great value from this kind of equation, in what may be called moral or prudential algebra."

From the foregoing it is clearly seen that the processes of reasoning and judgment really have very little in common.

Creative thinking, or planning, may include either reasoning or judgment, or both. However, it includes something more than these, though what that something more is, is not easy to say. It is necessary in such thinking to decide between one plan and another, or perhaps to choose among several; and here judgment is involved. But, before this stage is reached, it is required that we find or devise as many plans as possible from which the subsequent choice is to be made. This ability to devise or conceive many possible plans is no less important than that of choosing the one that is best from all that have been found. It is clear that the process can go wrong at either point, and also that the priceless "gift of originality," so-called, really consists of the dual ability described above. Those people have it who commonly find not one or two but many plans for accomplishing their purposes, and who compare these carefully until the one that is best of all is determined.

As we contemplate the very great difference which exists between the reasoning process and that of either judgment or creative thinking, we find it increasingly difficult to believe that training for the one can have any great influence upon the development of the other. Elements of any description that are common to the three types of thinking are few. Yet we are compelled to believe that such "transfer" as can take

place is accomplished through elements of this kind, and that their number determines its extent.

How Good and Poor Thinking Differ

There is a great difference in the judgment ability of adults and likewise in their ability to do creative thinking. Many men are known for the soundness of their judgment, just as many others are known for their lack of it. In the same way, the distinguishing mark of so-called genius is often creative ability, while at the other end of the scale are some who seem to lack it almost entirely.

We can hardly fail to ask, Wherein does poor, or inferior, thinking differ from that which is regarded as superior?

In general, all people seem to draw inferences, or to form opinions, early in their thought processes; but poor thinkers are often satisfied to stop at this point whereas good thinkers are not, but proceed to test their inferences carefully by comparison with as many additional, relevant facts as can be found.

Similarly, poor thinkers do not weigh their facts carefully in relation to the questions at issue; are unwilling to modify an inference, or opinion, that is found to be in conflict with facts; admit and consider irrelevant facts along with others; allow themselves to be diverted from the main problem to others that may unexpectedly arise; tend to discredit the facts that do not agree with their inferences and to magnify those which do so; often seem to think destructively, or negatively, as if deeming it more worthy to point out the mistakes and faults in the thinking of others than to reach right conclusions themselves; and so on.

As we consider the common faults in thinking that are observed on every hand, we may easily formulate a code of rules which apparently ought to govern the thought of all people. It would be about as follows:

RULES OR STANDARDS OF GOOD THINKING

1. Draw an early inference or opinion, based upon such facts as are known; then test it by comparison with all other facts relating to it that can be found.

2. Revise or relinquish this inference, or withhold final judgment upon it, if it is found to be in certain conflict with any single fact.

3. Weigh the facts with utmost care.

4. Hold close to the problem, excluding everything that is irrelevant or immaterial.

5. Keep mind entirely free from bias or prejudice.

6. Avoid premature conclusions, that is, conclusions not fully warranted by the facts, or conclusions based upon knowledge of only a part of the facts.

7. Accept conclusions willingly as soon as warranted by the facts.

8. Refuse to discredit or distort facts that tend to refute an opinion already held, or to magnify those that support it.

9. Think constructively, endeavoring to find the right solution, rather than merely to prove wrong the answers of others.

10. In attempting to discover or establish general principles, laws or truths, give chief consideration to typical, as distinguished from exceptional facts and cases.

Can Thinking Ability Really Be Developed?

Let us now turn our thought to the question, not hitherto considered, of whether it is actually possible

to develop a high order of thinking ability in the young people in our schools.

There are some who hold that the ability to think is an hereditary trait, related to, if not identical with, intelligence. As such, it can probably not be changed by training any more than can the color of one's eyes or hair.

This view seems to disregard the common, yet none the less grave, faults in thinking arising from the failure to observe the standards, or rules, which are stated above. Persons of superior mental ability seem to violate these standards as frequently and flagrantly as do others; and it is quite certainly true that most of the inferior thinking that is done by people in general really seems due to the violation of these rules rather than to the lack of inborn thinking ability. Evidence of this is seen in the fact that in the deliberations of assembled groups of persons of superior mental ability, the actual quality of the thinking that is done seems not to be notably better than that of groups possessing at most only average "intelligence."

A legitimate inference seems to be that the development of thinking ability is largely or mainly a matter of training our young people to observe habitually the standards of good thinking, rather than one of altering in any way their inherited mental capacities or traits. These standards, as we have already seen, are merely general rules which should be applied to specific situations. Such training *is one* with other education generally; and if our young people really can not learn to apply rules as simple as these in their thinking, then we must apparently cease to believe that other

general rules, laws and principles are of any value when taught to the young. This would indeed be hard upon our modern systems of education.

There is still another group of thinkers who hold strongly to the opinion that thinking ability cannot be developed, for the reason that it is not a general ability at all but an aggregate of specific abilities, instead. It follows, according to this view, that each specific ability would have to be developed separately; and this seems to these people an entirely futile and hopeless undertaking.

With this group we may easily agree. It is doubtless true that general thinking ability, so-called, is merely a composite of many specific thinking abilities. But it does not follow that these specific abilities cannot be given in school. Rather, if the curriculum is based upon the *actual needs and activities* of life, and if the rule of the school is that the pupils shall *learn by thinking,* then all of the important *specific* thinking skills that are needed in life should be involved in the work of the school and hence be developed, because such education properly includes all of the abilities, whether mental or manual, that life itself includes. If some are missed, then the school by so much falls short of its appointed function. The traditional school, offering the traditional type of education, has not, of course, developed many specific thinking abilities. What the school can do, however, is a very different matter; and in the degree in which it comes to discharge its true obligations, it will take care, without difficulty, of all of the specific thinking abilities that are of consequence in life.

Where the Emphasis Should Be Laid

As we sum up the thought of the preceding paragraphs, we can hardly fail to conclude that the ability to think well *can* be developed through training; that this end will be attained, not by endeavoring to develop a single, general ability, but many specific abilities instead; and that, in the development of each of these abilities, the standards of good thinking given above must be constantly and rigorously applied.

Insofar as the school has endeavored at all to develop thinking ability, it has sought to do so by training in reasoning, or mathematical thinking. Such work is of great value. Yet it should clearly be supplemented by training, the purpose of which is to develop genuine skill in judgment and in creative thinking. Our efforts to develop the ability to reason well should not be in the least abated. But it is necessary still that we put forth even greater efforts to develop the more important types of thinking ability named above. It implies the general use of judgment and creative problems, as well as the faithful observance of the standards of good thinking in their solution.

The standards of good thinking, as given in this chapter, are really those of *the scientific investigator.* He, rather than the mathematician, gives us the rules that should govern all judgment and creative thinking. We have too long looked upon his standards of thought as something for which he alone had use. Instead, they are universal standards—the rules which everybody should observe in the thinking of everyday life. When mankind has learned to use them habitually, a new day will doubtless be ushered in, more excellent

than any of which we have yet been told by those who see visions or dream dreams. Yet, strangely, the actual application of these standards in human thinking does not seem in the least difficult.

PROBLEMS FOR THE STUDY HOUR

1. Are the standards of good thinking, as given in this chapter, opposed at any point to human nature?
2. What explanation, if any, can you offer for the fact that our schools seem to be trying to teach children to think as mathematicians think rather than as scientists think?
3. What are the chief merits and the chief difficulties of the plan suggested by Benjamin Franklin for arriving at more accurate judgments?
4. Assuming that the youth of our land were really taught to observe habitually the standards of good thinking, what are the most important social changes that would probably be witnessed in America during the next generation?
5. How would you account for the fact that many people seem more anxious to make the facts fit their opinions than to make their opinions fit the facts?
6. Do you agree with the common assertion that every person is entitled to his own opinion? Justify your answer.

HELPFUL READINGS

PRINGLE: Methods With Adolescents, pp. 69–72.
DEWEY: How We Think, pp. 20–28.
KLAPPER: College Teaching, pp. 72–82.
BAGLEY and KEITH: An Introduction to Teaching, pp. 141–155.
BORAAS: Teaching to Think, Chap. 3.
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DEWEY: Democracy and Education, Chap. 12.
BODE: Fundamentals of Education, Chap. 6.
SCHAEFFER: Thinking and Learning to Think, Chap. 8.
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MIRICK: Progressive Education, pp. 12–27.
STREBEL and MOREHART: The Nature and Meaning of Teaching, pp. 176–188.
Columbia Associates in Philosophy: Introduction to Reflective Thinking, Chap. 4.
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KILPATRICK: Foundations of Method, pp. 241–246.

CHAPTER XIII

TEACHING STUDENTS TO THINK WELL

Assuming that it is really possible to develop in our pupils the ability to do sound thinking of the kinds that are used in later life, it becomes a matter of vital concern that the most effective procedure possible for the attainment of this end shall be determined.

A technique which includes at least five of the steps that seem to be essential in teaching pupils to think well is given below:

DEVELOPING THINKING ABILITY IN STUDENTS

1. Endeavor to create in your students a genuine and enduring *interest* in the ability to think well and an earnest *desire* to cultivate this ability in themselves. To this end, lead them into a study of the value of thinking ability to mankind, the benefits that would follow in every field if people would become able to think better, the great value to each individual of superior thinking ability as a determinant of his own future success, and others of similar kind. Strive thereafter to keep alive and growing the interest and desire thus created.

2. Lead the students, if possible, to discover for themselves and to state in acceptable form, at least a few of the *rules,* or *standards,* of good thinking. After this, the remaining rules may be found, one by one, as they are actually encountered in the thinking of the class. In every such case, with the concrete example before them, lead the students to formulate the

general rule, which should be added to their list and thereafter carefully observed.[1]

3. Provide constant *practice* in good thinking, not only during class discussion, but in study hour and laboratory exercise as well. This requires that virtually all subject matter shall be taught by means of problems calling for thought of superior quality.

4. In the solution of these problems, *adhere closely* to the adopted rules or standards of good thinking, keeping in mind:

a. That the class should, as a matter of voluntary choice, endeavor to hold to these standards.
b. That if they fail to do so, it means that interest in good thinking and the ideal of becoming good thinkers need to be strengthened rather than that the teacher should undertake to "enforce the rules."
c. That when standards are violated, the mistakes must be corrected without offense. Preferably it should be done by other members of the class rather than by the instructor.

5. In grading the work of students, see that *superior thinking is rewarded,* and that "loose" and careless thinking is penalized. Students should understand clearly that quality of thinking is a factor in determining their "grades."

The Ideal of Becoming Good Thinkers

The first paragraph of the foregoing technique really requires that an ideal shall be established in the minds of the students. The teacher must, as stated, arouse in them an interest in the ability to think well, then lead them onward to the point where this interest ripens into a genuine desire to become superior think-

[1] See list of standards of good thinking given in preceding chapter.

ers. Thus a goal, chosen by themselves, and for the attainment of which they may be expected to put forth willing effort, will be set.

The question may come as to whether this first suggested step is really necessary. To some it may seem a waste of time. "Why," they will ask, "may we not instead simply *require* that all thinking be sound, holding the students rigidly to the observance of this standard regardless of whether they really desire to adhere to it or not?" This plan, these persons will urge, is often followed in teaching the reasoning processes of mathematics. Furthermore, the elementary subjects, such as writing and spelling, are in many cases likewise taught with little or no attempt to arouse in the children a strong desire for their mastery.

With this view that the desire, or the ideal, does not matter in such cases, good teachers generally can hardly agree. They must hold instead that it makes a very great difference whether the pupils do or do not really desire to master the thing that is being presented, since the effectiveness of our teaching bears an exceedingly close relation to the strength of the desire of the pupils to learn what is taught. In the absence of such a desire on their part, our most earnest efforts seem unavailing. Nor is the reason far to seek. For if they have no desire to learn what we teach, they will have none to apply it; and it follows that they must forget it. This, indeed, appears to be the normal outcome of all those countless efforts to compel adolescents to learn things which they have no desire to acquire. Clearly, the same result may be expected if our students observe the rules of good thinking merely because they are forced to do so.

The Discovery of the Standards

Here, again, the plan suggested in the technique may be questioned. Why should our pupils be expected to discover for themselves the standards of sound thinking? Why not, instead, merely give them the list of rules, as a lesson to be learned, asking that these rules be carefully observed thereafter?

The answer is, of course, that we would have, in such case, learning by the traditional process of memorization with all of the attendant difficulties in application. If we would have our students apply the standards of good thinking in the concrete, then we must see to it that they learn these standards in the concrete. One of the illusions is that children who have been taught abstract generalizations will be found applying them later. Good teaching requires in general that we proceed from the concrete to the abstract. The technique, in suggesting that such be the procedure in this case, seems entirely sound.

The Teacher's Difficult Function

As the third and fourth steps are stated, it is required not only that the solution of problems be the constant and regular business of the school but that in the solution of these problems the standards of good thinking be carefully adhered to at all times.

How the problems may be provided for teaching the various subjects will be considered in the chapter next following. Here we should note the teacher's part in holding the class to the observance of the rules which are known to govern good thinking.

It requires, first of all, that the instructor form the habit of constant vigilance as to the quality of the thinking that is done by the class. This does not imply, however, that he should assume the role of fault-finder, nor yet that he should be watchful only for the mistakes that are made. Rather, he should cultivate the ability to recognize instantly either fine examples of the *observance* of the standards on the one hand, or on the other, instances, not always obvious, of their *violation;* and when cases of either kind are observed, the class should be asked to judge or evaluate the worth of the thinking that is being done. To this should be added, of course, a similar discussion of such examples of good or poor thinking as are noted by the students themselves.

The foregoing means, of course, that teachers and pupils alike should be constantly examining the quality of the thinking that is going on, giving to this no less attention than is devoted to the actual results of the thinking, that is, the conclusions that are reached in the solution of the respective problems. Thus will the habit of attention to this most important matter be gradually fixed in the students simultaneously with skill in the actual application of the standards involved.

Too often the tendency is to focus the attention upon the results, rather than upon the quality of the thought. Almost, it seems, this might be set down as one of the chief vices of problem teachers in general. Too many appear satisfied if the class merely arrives finally at the right answer; and very many correct conclusions are reached by thinking processes so unsound as to warrant fully the harsh criticism of problem teaching which is still sometimes heard.

Quality of Thought as a Basis of Grades

In view of the fact that methods of grading the work of the students are considered at length in a subsequent chapter,[1] only a brief discussion of this important problem is necessary in connection with the present study.

The proposal of the technique is that the quality of the thought that is done by the students should be a factor in determining their respective grades, though it is not held that this should be the only one. It means that in marking their papers, no less than in evaluating their contributions in class discussions, we should base our judgment in rather large part upon their actual observance of the standards of good thinking. If, for example, a student fails to take into account certain available facts, or does not seem to weigh his facts carefully, or shows prejudice in the handling of the facts involved, or otherwise disregards the accepted rules, his dereliction is to be penalized; and this should be done whether the conclusion reached in solving the problem happens to be right or wrong.

How great the penalty should be is, of course, for the teacher himself to determine; but it should be great enough to cause a feeling of dissatisfaction to attach itself to the careless act. On the other hand, the censorship should not be so rigorous and relentless as to cause failure to attend every effort, since this will result in the association of the obnoxious penalties with the whole attempt to become better thinkers.

Those who sincerely believe that grades should of right be based chiefly or entirely upon mere *possession*

[1] See Chapter XX.

of the facts, rather than upon the ability to think well, should not overlook the important truth that if we mark our students upon the latter we are actually taking into account their possession of facts. This is true because the facts must be used in the thinking that is done. Without the facts they cannot do it. It follows, then, that whereas the usual information tests show only the possession of knowledge, the thinking that pupils do *shows this possession and also their ability to use it* in reasoning, judgment and creative processes. Of the two, the ability to use it is not the less important; yet *this ability is missed* in information tests generally.

PROBLEMS FOR THE STUDY HOUR

1. Does there seem to you to be any considerable degree of truth in the charge that American youth can not learn to think because they are kept so busy learning lessons?

2. To what extent are high school and college teachers in general open to the accusation that is made by Montaigne against certain historians in the quotation: "The middle class of historians (of which the most part are) spoil all; they will chew our meat for us."

3. What studies, other than those suggested in the first step of the technique might be made to develop interest in good thinking?

4. Can all high school and college subjects be taught in such a manner as to keep students constantly thinking while learning them?

5. Name the chief difficulties that you would expect to meet in using the technique given in this chapter and state how you would endeavor to overcome each one.

6. Suggest changes in this technique which would, in your

opinion, result in improvement of the quality of thinking that the students would probably do.

HELPFUL READINGS

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SCHAEFFER: Thinking and Learning to Think, Chap. 1.
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CHAPTER XIV

FINDING AND USING PROBLEMS

In previous chapters, many references have been made to the necessity of using problems in our teaching as a means of bringing about learning by thinking rather than by the traditional process of memorization.

The questions of whether it is advisable that we try to teach all subjects by means of problems, and the extent to which it is actually possible to do this even if we so desire, have not been considered. Many persons have sincere doubts as to both points; for although they know that mathematics and to some extent, perhaps, the natural sciences lend themselves to teaching of this kind, they cannot see how suitable problems can be found by which to teach other subjects generally.

In this chapter we shall examine first the proposed technique for finding and using problems in high school and college subjects generally; and, after this, the question of its practicability will be considered.

FINDING AND USING PROBLEMS

1. Use problems representing typical life situations. Avoid those involving situations that are artificial or unreal.

2. When first formulated, each new problem should be scored upon the basis of the following standards:

a. The problem should be based upon a *true-to-life* situation 5
b. It should be *interesting* in itself, or clearly connected with other things that are interesting 5
c. It must be *clear and definite* in statement 5
d. It should be of proper *scope and difficulty* 5
e. It should call for *thinking of superior quality* .. 5

25

3. When any given problem has been scored, *revise* it in such a manner as to remove as many as possible of the indicated faults. Use no problem scoring below 20 if it is possible to improve it further.

4. Use problems (1) that are *inductive* in character; (2) that develop skill in reasoning or judgment; or (3) that develop *creative ability*. In general, follow this order in selecting problems by which to teach any given essential fact, principle or law. Avoid giving the creative problem before judgment skill is actually developed in some degree.

5. Plan to have the entire class solve the same inductive problems and the same reasoning and judgment problems. The creative problem may likewise be a group problem, or it may differ for individuals.

The First Source of Acceptable Problems

The foregoing technique in its opening paragraph sets forth a cardinal principle relating to the source of our problems. They should be drawn from *life* rather than from the teacher's imagination. That is to say, they should in general have their origin in the lives of people outside of school, though there is, of course, no objection to their arising in the actual experiences of the students themselves.

The problems, then, that should be used comprise simply situations arising in actual life, whether in school or out, in which the knowledge that is being studied is actually applied. It obviously follows that if no such situations really exist, no problems conforming to this first standard can be found; and in such cases we should be warranted in concluding that the knowledge in question has no real use outside the schoolroom and should therefore not be taught.

The Scoring of New-Found Problems

The second part of the technique proposes that our problems should be tested by means of a scoring process before they are used.

The purpose of this test is to eliminate serious defects that might otherwise make the problem ineffective in teaching. If the test is not made, such defects are not generally discovered until certain undesirable consequences reveal them. Apparently there is true economy in making such a critical examination of our problems as the proposed scoring process involves.

In scoring, or judging, a given problem, the observance of a few simple rules will increase in a considerable degree the accuracy in the results.

Thus in judging the first standard named in the technique, which we shall call "trueness to life," we should consider *not* how frequently the problem is met by people outside of school, but *what proportion of the class* will probably meet it. If we believe that *all* members of the class will meet it at some time in the future, we shall give the problem a perfect score of 5 on this point. If on the other hand we are satisfied

that *none* will meet it, or one substantially like it, we shall give it a score of 0 instead.

In scoring the problem on *interest,* which is the second standard named, we shall study it to see if any natural impulses are clearly and strongly involved *or if a clear connection is made with anything that is* truly interesting to all pupils in the class. If *one impulse* or more is strongly involved *or* if *one connection* is clearly made with a thing that is strongly interesting, we shall give the problem a score of 5 on this point. If, instead, we find that neither of these standards is fully met, we shall fix the score at the point dictated by our best judgment.

A perfect score of 5 on *clearness and definiteness,* our third standard, requires that the problem be so clearly stated that it can not well be misunderstood, and that all of the information be given that is necessary to make a definite solution possible.

Proper *scope* in a problem implies that it is not so small or narrow that it can be solved by the class in a very short time, nor yet so broad that its parts, or elements, tend to become dissociated in the minds of the pupils. Similarly, a proper degree of *difficulty* requires that the problem be neither too easy nor too hard for the particular class to which it is assigned. That is, a problem should be marked down on scope and difficulty if, on the one hand, it is too narrow or too easy, or on the other, too broad or too difficult. If it falls between these extremes as to scope and difficulty, it may be given a perfect score. If not, the score should be reduced according to the seriousness of the fault found.

The final standard is *quality of thought;* and this

is probably the hardest of all to judge. Apparently, thought of good quality should involve not merely one but several principles or laws. Moreover, it requires as a rule that these principles actually shall be applied to a specific situation. From this it follows that if a problem is too narrow in scope or too easy the quality of thought is liable to be low. Similarly, the thought quality could not be good if the problem were not clearly stated or if the information given is not sufficient to make a definite solution possible. However, the quality of thought may be impaired in other ways than those mentioned above. For example, it is generally low in that numerous class of mathematical and science problems in which it is only necessary to substitute known quantities in formulas and solve for the unknown quantities, since the latter process is mechanical and about the only thinking required is that necessary to determine the particular formula that should be used.

Examples of Problem Judging

Let us now apply these standards in the scoring of the following problem which might be given in high school physics:

> Why are cylinders containing gas under high pressure often labeled "Keep cool"?

Probably not more than one-fifth of the pupils in the average class will ever encounter this problem. We should therefore give it on *trueness to life* a score of 1.

The natural impulse of curiosity is involved, but

not at all strongly. Neither is any other impulse. Moreover, there is no connection with an external, interesting thing. The score on *interest* should therefore be set at about 1.

The problem can not well be misunderstood, and nothing is omitted that is necessary to its solution. On *clearness and definiteness* its score should consequently be 5.

It is very narrow as to scope and certainly not at all difficult. In view of these facts, its score as to *scope and difficulty* should perhaps be 1.

The quality of thought is not good, since only a single law is involved. There are no intricate relationships to be traced out but only the one which exists between the volume of a gas and its temperature. It follows that the score on *quality of thought* should be set at about 1.

Thus the total score of the problem would be 9; and, according to the technique, it should not be used.

Let us turn now to a problem from history which conforms more nearly to the accepted standards. It is stated as follows:

Is the suspicious attitude of the people of the Latin American countries toward our nation really justified?

Since most members of the class will, as American citizens, meet and reflect upon this problem sooner or later, it may be given a score of 4 on *trueness to life.*

The suspicion with which we are regarded by our southern neighbors is a truly interesting thing with which our policy of national expansion is here closely associated. Because of this excellent external connection, a score of 5 may be given on *interest.*

No fault can be found with the problem as to the other three standards. Since each carries a score of 5, the total score would be 24.

If this problem is even casually compared with the one previously scored, it will be seen that the great difference which the scores show really exists in their value for classroom purposes. The first would arouse only mild interest at best and would call for little effort on the part of the class. The second would prove strongly interesting and would receive the very best thought of which the students were capable. Indeed it would function as a nearly perfect problem notwithstanding it comes from a subject not commonly taught by means of problems.

How Problems Are Revised

Suppose that we wish to teach the results of the Civil War and plan to use the following problem:

> Lincoln's birthday, which occurs next week, reminds us of a stormy period in our nation's history—the Civil War. Please summarize the effects of this war upon both North and South.

The judging process shows this problem to have some very serious faults.

It is not a problem that the pupils will meet in the future. Only in the schoolroom do people have to "summarize results" in this peculiar manner. Probably none of the pupils will ever have to do so in later life. Therefore, its score on *trueness to life* should be 0.

Lincoln's birthday as an external source of interest is quite acceptable. But in this problem there is no

clearly apparent connection between it and the required summarization. Rather, its palpable use as a vehicle of something more or less unpleasant tends to deprive it of its intended value. As a result, its score on *interest* should be no more than 2.

On each of the next two standards, *clearness and definiteness, and scope and difficulty,* a score of 5 can be given.

The *quality of thought* is distinctly inferior. This arises from the fact that the students are asked only to *summarize,* which implies nothing more than reproducing what has been memorized. No application of knowledge is called for, nor yet any true reasoning or judgment process. The score on quality of thought may consequently not be set above 2.

Summing up, we find that the total score of the problem is only 14, and furthermore that its weaknesses are in *trueness to life, interest and quality of thought.* It follows that in the attempt to improve it, *our thought must be focused upon these three points.* The question really becomes one of changing the statement in such a manner as to strengthen it with respect to these standards without weakening it as to others.

Suppose, for example, that it were restated as follows:

> As Lincoln's birthday approaches we are reminded of the stormy period of the Civil War, through which he guided our nation. Would you say that the benefits, which have come to North and South from that struggle since his death, have been great enough to repay its cost in human lives and money?

As we examine this revised form, we shall doubt-

less observe a decided improvement as to the three points in which it was originally found defective. Let us rescore it to determine just to what extent it has been made better.

Most good American citizens, such as our students are expected to become, will at one time or another consider this question of whether the benefits of *the* Civil War have really outweighed its cost. On the point of *trueness to life,* we may therefore give it at least 3.

The external connection of the original problem, Lincoln's birthday, bears in the new one a close, clear, natural connection with the problem proper and serves as an excellent source of interest. The score on *interest* may, as a result, be set at 4.

On *clearness and definiteness,* and likewise on *scope and difficulty* the problem should still be given a score of 5.

The *quality of thought* called for in the new problem is excellent. Many facts must be taken into account and weighed most carefully against one another. As to this point, it should apparently have a score of 5.

Thus we find the total score of the revised problem to be 22. Moreover, we can easily see that the great difference which the scores show actually exists in the "teachability" of the two problems. While the first would be regarded merely as another school task, the second would spur the students to genuine effort.

It is clear that the method used here is really applicable to other defective problems generally. In the ability which it gives us to make poor problems good lies the great value of problem judging, such as has been considered in this chapter.

The Natural Sequence of Problems

It is stipulated in the technique that problems of three distinct kinds should be used: *inductive, reasoning or judgment,* and *creative.* These call for the types of thinking which are interesting to our students and which occupy the time of people generally outside of school.[1] It follows that the sequence suggested is to be regarded as essentially natural rather than artificial. However, there is something in this sequence which entitles it to even greater respect than would the facts mentioned above. In it, we appear to have a means of fixing knowledge more or less permanently in the minds of our young people. That is, if they (1) *discover* a truth *through thinking* as would be the case if it came to them through an inductive problem, (2) *use it in* either *reasoning or judgment problems* until they become truly skillful in applying it, and (3) *use it* in the solution of one or more problems calling for the working out of *original plans,* it seems hardly possible for them to forget it afterward. Moreover, there is considerable evidence that knowledge so acquired is actually retained far more tenaciously than is that acquired by other means generally. Growing as it has out of a study of nature's learning process, it seems to represent one of nature's very best suggestions for the improvement of the teaching that is done in our high schools and colleges.

As a partial example of such a problem series as is here suggested, let us suppose that a health class is studying the communication of disease through micro-

[1] See pages 36 and 88.

organisms. The study is opened with some such problem as that below:

Last week one of our number came to school with a cold. Three or four days later others were suffering in the same way, and now it seems that still more of us have colds or are recovering from them. If we assume that they are caused by some kind of germs too small to be seen, how did these probably pass from one person to another as they seem to have done?

This is, of course, an inductive problem since it will lead to the discovery of new truths, that is, the ways in which microorganisms may be transmitted from person to person. These methods will be understood, since they will be found and thought through by the class.

After this, a number of judgment problems are given similar to that which follows:

A classmate is taken down with meningitis. You recall that the day before he left school he borrowed and used one of your books. Would you destroy it?

The problems of this type will be so chosen as to involve a number of typical situations arising in connection with common contagious diseases, and to require reasoning or judgment as to methods of meeting these situations. The number is governed by the difficulty of the thinking that is called for but should proceed to the point where the students have developed sound judgment in discerning between good and poor ways of combating microorganisms.

Finally, one or more problems of the creative type are in order. Such a problem may be stated as follows:

> Will you try to devise a feasible and effective plan for preventing the usual epidemic of colds in our high school during the coming winter? Please describe it fully, stating why it should accomplish the result sought.

In the solution of this and similar problems, it is clear that sound judgment will play a large part. Indeed, if such judgment has not been developed, good plans can not be expected when the creative problems are undertaken. In the same way, the judgment problems can not be solved until the principles have been established through the inductive problem. It is obviously a serious mistake to assign the creative problem first, as is rather frequently done in teaching the vocational subjects. Even more objectionable is the practice of *giving* the principles ready-made to the students and requiring simply that they be learned, thus omitting the inductive thinking altogether. This is true even though an attempt is made to overcome the harm done by multiplying the subsequent reasoning problems unduly, as is frequently done in mathematics and the physical sciences.

If we truly seek to develop *abilities* in our pupils, rather than merely to teach them information, we shall find it possible as a rule to provide problem series patterned after that above for the attainment of our desired ends. In general, every intellectual ability can be taught by such a series. The chief exception to this occurs when the desired ability is one of reasoning or judgment only and does not include or require any-

thing in the nature of original planning. Such abilities are quite common in both the natural and social sciences. The rule is, of course, that if the ability to be developed is one of reasoning or judgment only, the creative problems should be omitted from the series.

Proper Use of Individual and Group Problems

It is a first rule in problem teaching that all students should, as far as possible, be kept working on the same identical problems. Only when this is done can the best group thinking be secured. If all have worked upon the same problem during the study hour, the students can "check" one another's thought and will inevitably do so in the subsequent class discussion. If they have worked upon different problems instead, the very great value that comes from this checking and testing process is missed. It follows that individual problems are, in general, to be avoided, at least until the latter part of the creative stage has been reached in the problem series.

Suppose, for example, that we have a class studying interior decoration. It is clear that the inductive problem, in which the principles are established, may be the *same* for the entire class. Likewise in the judgment problems, in which the class will probably judge between decorative schemes found in actual homes, all members may work upon the *same* problems. Even the first creative problems may be group problems; for it is entirely proper to choose the same home, let us say, and ask all to work out a decorative scheme for it. After a satisfactory degree of skill has been developed in this way, but *not until then,* does it seem

permissible to have each student work out a plan for the decoration of the interior of his own home.

PROBLEMS FOR THE STUDY HOUR

1. Score the following problems as to *trueness to life* and *interest:*

   a. Which would be warmer, fur-lined gloves, or the same gloves made with the fur outside?
   b. At what time between seven and eight o'clock are the hands of a clock exactly opposite each other?
   c. Should the publication of crime news be regulated by law?
   d. Will the "water line" of a boat rise, or will it fall, when the boat goes from fresh water into salt water?

2. Score the problems below as to all points included in the score card given in this chapter:

   a. Do political parties make for better, or for worse government in our country?
   b. A piece of metal which weighs 9 lb. in air weighs only 5 lb. when suspended in water. What is its specific gravity?
   c. On a day when the temperature is the same as that of your body, could you cool yourself by fanning?
   d. Should our nation in the future seek to extend its territory farther?

3. Revise the following problems after scoring them. Then score again as impartially as before to determine how great the improvement has really been.

   a. Are the homes of today producing as good citizens as the homes of our grandfathers?
   b. Does a tall tree near a house increase or diminish the danger that the house may be struck by lightning?

HELPFUL READINGS

COLVIN S. S.: The Learning Process, pp. 313–318.
DEWEY: Democracy and Education, Chap. 12.
AVERILL: Elements of Educational Psychology, pp. 202–219.
MIRICK: Progressive Education, pp. 230–248.

CHAPTER XV

GUIDING STUDENTS IN PROBLEMS SOLVING

No assignment, in the sense of a lesson to be learned, should ordinarily be made in connection with problem teaching. Instead, one or more problems are put before the class; and the efforts of the group are devoted to the solution of these problems, rather than to the acquisition of a stipulated amount of fact material. Thus the difference between the traditional teaching process and that which becomes necessary when we set out to develop genuine thinking ability in our pupils becomes very sharp indeed at this point.

A suggested technique for the presentation of the problem to the class and for guiding the students' efforts in the most helpful manner toward its solution follows:

PUTTING THE PROBLEM BEFORE THE CLASS.

1. As a preliminary step, endeavor to have the class meet the problem incidentally while engaged in the solution of another problem. With proper planning, the new problem will seem to grow naturally out of the old. When unexpectedly met in this way, the class should attempt to solve it, continuing the effort only to the point where each student feels that he knows the correct "answer."

2. At any appropriate time after the attempted solution referred to above, assign the new problem for study, stating

it so carefully that none can fail to understand clearly its exact meaning.

3. After the problem has been stated, endeavor by a brief talk or otherwise to increase the interest of the class in it, if this seems advisable. In this attempt, endeavor to make clear the relation of the new problem to some large ability or skill which the course is to give them. Aside from this, use should be made of as many of the interest skills as possible.

4. If special difficulties are liable to be encountered that will interfere with the solution of the problem by the class, remove these difficulties by proper explanation.

5. Avoid, as far as possible, giving references to sources of information, save to those students actually *known* to need such help.

6. To the weaker students *only*, a few thought questions leading to the solution of the problem may likewise be given.

The Life History of a Problem

In a true sense, the first step in putting a new problem before a class is taken when it is made to emerge from an old one while the latter is being solved by the group. This preparatory step may or may not have been taken a considerable time before the new problem is given out for final solution.

Because of its origin as described above, the new problem should have borrowed interest from the old one. Furthermore, if the attempted solution has been made as suggested, each student will have arrived at an inference, such as is required by the first standard of good thinking. With interest, then, to serve as a stumulus, and an inference already drawn with which further facts may be compared as they are met, it is reasonable to expect that the minds of the students will be kept in a state of more or less constant readiness to

take up the new problem at any time. Something like this seems actually to take place; for when the problem is given to them later, they recognize it and undertake its solution with apparent interest. Apparently, too, as stated in Chapter VII,[1] the connection, or bond, existing between the new problem and the one from which it originally came forth is reestablished unconsciously. It is because of this rather strange chain of events, spontaneously following the making of good forward connections, that the latter seem so valuable a feature of all teaching, the purpose of which is to fix knowledge premanently in adolescent and adult minds.

Giving the New Charge of Interest

If the new problem has grown naturally out of some preceding one, as suggested above, with the forward bond established while the first was being solved, and if, moreover, the new problem is closely and clearly connected with the one just solved, as should always be the case, the interest borrowed from these two should make it immediately interesting to the class. However, we should not be satisfied with this. It is for us still to add to this store such interest as can be brought into it through the use of the several interest skills considered in previous chapters of this study.

The new problem may, for example, bear clear relationships to things outside the school in which the students are already interested, thus permitting *external connections* to be made. Or it may be found that *natural impulses* can be easily involved; or perhaps a way may be found for increasing the *feeling of need.*

[1] See page 61.

By the use of any of these or other interest skills, new interest may be brought into the problem to be added to that which has come to it from preceding problems. Needless to say, all such possibilities should be carefully considered and the suggested interest skills thoughtfully applied at the time the problem is given out for study. Not only will the new problem thus be made more interesting, but the store of accumulated interest to be carried forward to succeeding problems will be made so much the greater.

Making Students Able to Find Needed Facts

Our great ultimate goal in problem teaching is to make our students able to *solve new problems without help.* In later life, these students will be constantly meeting new problems; and since there will be no teacher at hand, they must, in general, solve the problems unaided. In the degree in which we make our young people able to do this, we shall have truly educated them. Conversely, if we send them forth unable to solve new problems independently, they will hardly have been educated in any worth-while sense.

With this in mind, we may seriously question the usual practice of telling students where to go for the information that must be used in the solution of their problems. Rather, it seems much better to require them to find without help, as far as possible, the facts that they need. This plan must, of course, be applied in a sensible manner since it has certain obvious limitations.

The first step in this direction is to give them the ability to find anything that the textbook may contain relating to problems upon which they may be working.

Even this may trouble them at first; for it is a characteristic of problem teaching that it does not follow the order of any text. Neither should any effort be made to have it do so. Instead, the facts that are necessary to the solution of the respective problems may be found in any part of the book. They must be searched out by the class; and this requires that the index and table of contents be constantly used. After this, it is easily possible to add other reference books or bulletins from time to time to the list of sources of information. Thus the students will gradually become able to find the facts that they need, provided the available books contain them; and at the same time they will become familiar with much of the best literature relating to the subject that is being studied, rather than with a single book only.

It is possible, of course, that the less capable members of the class will not be able to search out information in this manner. As suggested in the technique, they should receive help, but this only after they have made a conscientious search. If they are held to the requirement of finding the facts that they need, the ability to do this should gradually be acquired. On the other hand, to give to all students in the class specific references to the places where the facts may be found is to deprive them of any chance to develop one of the most important of all abilities to be gained in school.

Teaching Students to Think Independently

A common practice is to give to the class a list of questions intended to guide them in the solution of the problems that have been assigned. The purpose is, of

course, to make them able to solve problems which would otherwise be too difficult.

Let us recall the fourth standard used in the judging of problems,[1] which required that the latter be of proper scope and difficulty. This standard clearly implies that the teacher should present problems that the students can solve, rather than assign problems which they cannot solve and then help in their solution by questions or otherwise.

It is desirable that we give most careful attention to the matter of adjusting our problems to the ability of the class. Since students differ in ability, however, we shall, despite this, have some who are unable to solve all of the problems that are given to them, whereas the brighter ones can do so without help. To help the latter when they do not need it is to deny them their rightful chance to grow in mental strength and stature. Only in the face of peremptory necessity should it be done. In the same manner, those who cannot solve the problem without aid must have help lest they be weakened by failure. Thus the teacher finds himself in a perplexing dilemma; for the course that will help the strong will injure the weak while that which will strengthen the weak will weaken the strong.

The solution must apparently be as set forth in the technique. That is, help in the form of skillfully formulated questions should be given, not to the class as a whole, but to individual students when the necessity actually arises. Thus the mischief which comes from helping those who do not need it will be avoided without depriving others of the assistance which should be given.

[1] See page 117.

PROBLEMS FOR THE STUDY HOUR

1. How would the habits of study which the problem teacher would wish to develop in his students probably differ from those desired by a teacher of the traditional type?

2. In the light of this chapter, what do you regard as the right way to use textbooks in teaching high school and college subjects generally?

3. In general, would you say that a teacher can assign well a problem that he has not himself solved?

4. It is held by some that books should be used to supplement the thought of the students rather than to supplant it, but that as actually used they do the latter instead. What measure of truth do you see in this assertion?

5. In an essay by Schopenhauer we find this statement:

> "It is dangerous to read about a subject until we have thought about it ourselves. When we read, another person thinks for us; we merely repeat his mental process. So it comes that if anyone spends the whole day in reading, he gradually loses the capacity for thinking." Is it to be regarded as essentially true or false?

6. Does this technique seem equally well adapted to the bright and dull students in mixed groups?

CHAPTER XVI

PLANNING FOR THE CLASS DISCUSSION

A QUESTION often raised is whether it is really possible to plan in advance for group thinking in view of the uncertainty in any given case as to the direction that such thought will probably take. Only a prophet could foreknow this; and as for teachers, few indeed seem able to guess at all well what young people will either think or do next. How, then, can they make plans in advance for handling so uncertain a thing as the joint thinking process of a considerable group of youthful minds?

Probably the difficulty is not so great as it appears at first. The teacher's task is to *lead,* rather than to *follow* the thought of the class, just as he should lead rather than follow their interests. Indeed we should not lose sight at any point in the present study of the teacher's true role as leader and guide. This is the relation which he sustains to the thinking of his students as they endeavor to solve the problems put before them. Yet this does not imply that they are forced to think in a predetermined "groove." Rather, the teacher must foresee the difficulties in the solution and be ready to offer help at these points.

Let us examine the proposed technique for laying plans in advance for group thinking and discussion:

PLANNING FOR THE CLASS DISCUSSION.

1. Prepare a brief introduction to connect clearly the new problem, which is about to be taken up, with previous thought of the class. Avoid at this point mere reiteration of facts that have been previously studied.

2. As the second part of the lesson plan write a statement of the problem as given in the assignment.

3. After this, prepare a question, as interesting in form as possible, that will call for the "answer" of the new problem.

4. Work out, and include next in the plan, a list of thought questions, each of which will be recognized by the class as leading a step nearer to the final solution of the problem, and the answers of which, taken together, will actually constitute a solution of it.

5. Following each of these questions separately, indicate by name only:

   a. Natural impulses that may be involved.
   b. External connections that may be made.
   c. Forward connections that may be made.
   d. Concrete illustrations, demonstrations or objective material, that will help the class to answer the particular question.

6. Add such touches as can be devised (1) to increase "feeling of need" for skills that are being developed or are yet to be developed, (2) to strengthen any ideal involved, or (3) to increase the "sense of progress."

7. Make the assignment of the succeeding day's problem at any chosen point, giving preference to the particular time at which it emerges most clearly and naturally from the thought of the day. If the class finds the new problem at this point and are interested in it, they should be allowed to "try it" before the assignment is made.

The Opening of the Discussion

The first step required in this technique is to establish carefully the connection between the problem about to be taken up and that which has gone before. The imperative need of this connection was explained in Chapter VII[1] and methods by which it might be made were suggested. A really good introduction requires as a rule not more than a minute or two in presentation; yet it establishes the closest possible union between the new problem and one or more that have been previously solved.

It can not be too strongly emphasized that there are far better ways of establishing this union than merely to repeat or restate what has been already studied, or to ask the pupils to do so.

After the introduction has been made, the question first put to the class as the discussion of the new problem is begun is that calling for the *answer,* or conclusion, reached by members of the class. This suggestion is not in accord with the usual practice. Rather, the rule ordinarily followed is to call at the beginning for the facts that have been gathered pertaining to the problem, leaving the conclusions reached to be stated later. This practice is essentially unsound. If the facts are called for, without any reference to the conclusions toward which they seem to point, the process is uninteresting and very little or no thinking results. On the other hand, if the answers, or conclusions, that may have been reached by members of the class are brought together at the beginning,

[1] See page 54.

genuine thinking starts at once as to which one is probably right.

With the various answers in, the teacher may next ask the students for the *reasons* for their conclusions; and these reasons will turn out to be the identical *facts,* which would have been merely recalled if the traditional practice referred to above had been followed. Now, however, each one of these facts, as it is stated by some member of the class in defense of his views, will be carefully compared with the various answers that have been submitted. It follows that the thinking which started when the conclusions were called for at the beginning continues thereafter without interruption. In view of the above, it is to be regarded as good practice in problem teaching to call for the conclusions at the very beginning of the discussion, and after this to bring in the facts one by one in the form of reasons offered in defense of one or another of the contending views. This method of opening the discussion is apparently applicable to all problems.

When the Discussion Goes Wrong

It is, of course, desirable that the opening question referred to above shall bring in one or more answers of the problem, which has been studied. In such case, the business of the class becomes at once to determine which of the answers given is right, or if only one has been given, whether it is right or wrong. Thus the general course of the discussion from this point is fixed; for it must lead to and establish the right conclusion in the face of opposition, and this without suppressing or discrediting in any way the best arguments that may be offered for the opposing views.

It may happen, however, that the class has failed to solve the problem and therefore has no answer to offer. What should the teacher do in such case? Evidently this possibility should be taken into account and provision made in advance to meet the situation that would thereby arise.

This is the real purpose of the fourth step of the technique, which requires that a list of thought questions be made ready for use in case the need for them arises. They are meant to lead the students by "easy stages" through the solution of the problem that has proved too difficult for them. These questions should be carefully prepared to the end that they may lead to really clear understanding on the part of the class. Yet it should be remembered that they are not to be used if the students have arrived at conclusions of their own. Although the questions are of very great value if needed at all, it would still be a serious mistake to lead the class by their use through the successive steps of a solution which they had already worked out for themselves.

Planning the Discussion of Each Question

After the series of questions has been prepared as just suggested, it is advisable to give some thought to the manner in which they will be handled. The technique suggests at this point that certain brief notations be made under each one to guide the teacher in conducting the discussion of it.

It will be observed that although little is actually to be written under each question, even this little really calls for a study of how to apply several of the interest skills to the particular question.

As the teacher lays his plans for handling the first question in the list, for example, he will study it to determine what natural impulses may be involved, what external connections may be made, and so on, as suggested by the technique. As the opportunity to apply a particular skill is seen in a given case, a word or two is jotted down to serve as a reminder when the discussion is under way.

When to Assign the New Problem

There seems to be no general rule as to when the problem for the next study hour should be assigned. Three are commonly followed.

The one that is probably used least, yet that seems to be most nearly ideal, is the one given preference in the technique. It requires that the teacher shall choose the point at which the problem next to be taken up emerges most naturally from the current day's discussion and shall assign it at that time. This would obviously insure the closest possible bond between the new problem and the one with which the minds of the class are occupied; and because of this superior internal connection at the point of greatest danger,[2] the plan suggested should probably be used wherever practicable.

A second plan is to assign the new problem at the beginning of the hour before taking up the discussion of the problem of the day. This plan has an advantage in that it permits the teacher to assign the new problem without hurry and therefore to put it before the class in a more satisfactory manner. There is a seri-

[2] See page 56.

ous objection to the plan, however, if the current problem needs to be solved before the relation of the new one to it can be seen by the class.

A third plan, and the one perhaps most commonly employed, is to assign the new problem at the close of the discussion, usually in the closing minutes of the class period. The great objection is that in an interesting discussion the teacher may forget how rapidly the time is flying and when he comes to himself it is often too late to assign the new problem in a manner that will make good study possible. This objection is so serious in practically all problem teaching as to make it advisable to avoid wherever possible the assigning of a new problem at the close of the class period.

The Form of the Written Plan

The traditional form of double-column "lesson plan," the first column of which includes the subject matter to be taught, does not seem well adapted to problem teaching. Neither is it necessary, apparently, that the plan shall be written upon sheets of paper of notebook size, as is the usual practice.

Probably the plan is most satisfactorily kept on ordinary cards 3 x 5 or 4 x 6 inches, with the lines written across rather than lengthwise of the cards. Such cards are sufficiently large for a plan of the kind described in this chapter. Moreover, they are more convenient to use than are sheets of larger size and they are easily filed for future reference.

The last suggestion does not mean that a plan once used may be filed away and used again later.

Rather, a new plan should ordinarily be prepared for every class discussion, regardless of how often the problem has been previously solved by other classes. But if the teacher can refer to plans used on previous occasions, and particularly if before filing them away he has written on the backs of the cards such suggestions as may have occurred to him for improving the procedure, the cards will prove exceedingly helpful when new plans are to be made.

It is, of course, true that if a teacher is not thoroughly familiar with his subject matter, he should have it written into his lesson plan. In this case it is perhaps best to use sheets upon which the subject matter may be outlined. However, a fundamental proposition of problem teaching is that the teacher should not only know well his subject matter but be able to use it in the solution of problems in which it is applied. Given this degree of mastery of his subject, the preparation of a plan which includes an outline of the knowledge to be taught becomes quite unnecessary.

PROBLEMS FOR THE STUDY HOUR

1. Why is it regarded as so highly important that the introduction connect the new problem as closely as possible with *preceding ones?*

2. What relation, if any, can you see between the first standard of good thinking and the plan suggested in this chapter of calling first for the answers of the problem and then for the reasons for these answers.

3. Taking a good problem in your own special subject, assume that it has been assigned to a class. Write the thought questions which you would have in readiness to use in case the class came without a solution.

4. Show why your questions should, if answered by the class, actually give them a clear understanding of the problem as a whole which they have failed to solve.

5. If a teacher has assigned a problem previously used in another class, why should he not use the same lesson plan?

HELPFUL READINGS

DEWEY: How We Think, Chap. 15.
ELLIOTT: The Process of Group Thinking, Chap. 5.
ELLIOTT: The Process of Group Thinking, Chap. 7.

CHAPTER XVII

LEADING THE CLASS DISCUSSION

The highest of all teaching skills is that of *guiding group thinking.* All others are really included in this one; for it is literally true that they are the elements of which it is composed. In a really good class discussion, several of the techniques already described are often seen in use at the same time.

Very many teachers who are themselves good thinkers are still unable to guide skillfully the thought of their classes. It is one thing to understand the correct solution of a given problem, but quite another to know what to do in every situation that may arise when a group of youthful minds is wrestling with it. Yet the teacher must always know just what step should be taken next, however puzzling the circumstances in which he finds himself.

If this seems to imply that the leading of the group discussion is a mechanized process, it should be said once for all that such is very far indeed from the truth. Rather, it is a matter of applying general rules or principles to the treatment of a countless succession of situations which are ever new.

Below is given a technique, which is sufficiently definite to enable the teacher to handle satisfactorily such situations as ordinarily arise in group thinking:

LEADING THE CLASS DISCUSSION

1. Open the discussion by use of the introduction which has been prepared in advance.

2. State the problem again, if this seems advisable, in form in which it was given out for study.

3. Ask for "answers" of the problem as worked out by members of the class. Do *not* allow discussion to start nor any reasons to be given until all answers are in. After this, follow that one of the three plans below which is found to be appropriate under the circumstances:

a. If *two or more different answers* have been submitted by members of the class, ask advocates of each to give reasons for their beliefs, or for opposing the beliefs of others. In the discussion that will ensue, endeavor to keep the arguments so evenly balanced as to maintain a high state of suspense. Without distortion of facts, help, as necessary, the adherents of losing views, by reinforcing their arguments or by finding and attacking the weak places in the arguments of their opponents. After all facts favorable to weak or incorrect views are known, allow advocates of the right view to speak without hindrance until their case is won if they are able to carry it to this point. If not, help them to do so by citing facts that may have been overlooked.

b. If the *entire class has reached the same conclusion,* offer one or more plausible alternative answers, with arguments strong enough, if possible, to establish doubt. If some students "weaken," and accept the new view, allow them to argue for it, conducting the discussion as in the preceding case. Otherwise, defend it until class has proved its own view correct if it is able to do so.

c. If *no answer of any kind* is submitted, put to the class, in order, the *list of questions* that has been prepared in advance and included in the written plan. In case any one of these questions should prove too difficult, use the *illustrative material* as suggested in the lesson plan, thus changing from generalized or abstract thinking to that which is concrete. If the class is still unable to answer the question, *suggest two or three possible answers,* allowing the class to test them in open discussion until the right one is found. If they still fail, *give the right answer, with reasons in full, allowing the class to* decide as to soundness of conclusion.

4. Throughout the discussion, be alert for passing opportunities to:

a. Build permanent interest.
b. Strengthen ideals.
c. Arouse "feeling of need" for abilities being developed.
d. Make external or forward connections.
e. Involve natural impulses.

5. Make assignment at any appropriate time.

Setting the Stage for the Discussion

Much depends upon the manner in which the discussion is opened. The tendency on the part of the students, which, according to the technique, is to be avoided, is to give their reasons along with their answers, whereas that of the teacher is to test each conclusion as it is given to determine whether it is right or wrong. The careful weighing of the facts, that is necessary in determining which answer is really

right, demands that the various conclusions shall be clearly stated at the beginning and kept separate from the facts cited in their support. That is, if conclusions and reasons are allowed to become a confused mass in the minds of the students, it will operate strongly against clearness of thought. Furthermore, if each conclusion, or answer, is tested by discussion as it is given to determine whether it is right or wrong, some conclusions will not be given a hearing at all and the evidence or facts which happen to support them will be automatically excluded. Thus the stipulation of the technique seems fully justified.

The First Typical Situation

The situation first considered in the technique—that in which *two or more* different answers are given by the class—is one that is greatly to be desired. The disagreement results in competitive thinking. In general, the human mind thinks harder and better in this circumstance than in any other, owing in part to the desire to win and its consequent careful examination of the evidence cited by its opponents but also to the searching scrutiny of its own conclusions by others.

The procedure suggested in the technique has doubtless been already recognized as that submitted for creating and maintaining suspense.[1] This is clearly warranted in view of the fact that a state of suspense is favorable, if not indeed essential, to protracted thinking, such as is desired in the solution of problems.

If, therefore, it should fortunately come to pass

[1] See page 69.

that the discussion opens with two or more conclusions before the class, each with its own defenders, the teacher's "strategy" is entirely clear. It is for him, as stated in the technique, to keep the argument as delicately balanced as he is able, not allowing any view to gain an advantage over the others. This condition is to be maintained as long as the stream of evidence for or against any conclusion continues to flow in. When it ceases, the gates may be opened for any other that may be waiting. Thus all the relevant facts will finally be brought into the discussion; and if they warrant a decision in favor of a particular conclusion as against the others, the class may be depended upon to reach it.

We may say then that, given this typical situation of disagreement at the beginning, there is a normal, easily guided, forward movement of the thought to a definite conclusion if such a conclusion is really warranted by the facts.

A Second Typical Situation

Another situation that may be met as the discussion opens is that in which the entire class is found *agreeing* as to what they believe to be the correct answer of the problem. Whether this answer is actually correct or not, does not matter from the standpoint of procedure. The essential point is that we have agreement rather than the disagreement, such as was assumed in the first situation above.

As stated in the technique, when such agreement is found, the teacher should apparently endeavor to set up alternative conclusions in opposition to that which

the class has reached. That is, he should suggest one or more possible conclusions, different from that reached by the class, citing certain evidence which seems to support them or to refute the answer which the class believes to be correct. It is not necessary, of course, for him to prove that one of the newly suggested answers is probably correct. As soon as it becomes apparent that one of these conclusions *might* be right, doubt is created; and this is the end that is desired. However, if he can present arguments strong enough to cause some members of the class to accept one or another of the new views, the situation is still better. For he will have changed agreement into disagreement; and so this second situation will have been actually converted back into the first.

In case the answer arrived at by the class is really correct, it may prove difficult for the teacher to set up opposing conclusions with evidence sufficiently strong to win support from the class, though this may very often be done. If the attempt fails, it will be for him to defend them himself until they are definitely refuted by the class. Although this procedure is not always entirely satisfactory, it may be said still that it not only stimulates lively thinking but compels the students to defend their own view against the strongest attack which the teacher is able to bring against it. This is highly important. For while a right conclusion may be arrived at by loose or careless thinking, it can not be upheld in the face of strong opposing argument unless it is thoroughly comprehended. To allow any correct conclusion to pass unchallenged seems to be a most serious mistake even though it has the unanimous support of the class.

If the conclusion reached by the group and presented at the beginning happens to have been not right but wrong, it is comparatively easy for the teacher to establish contrary or opposing views that will gain open support by some members of the class. It follows that in this case the class will carry both sides of the argument, leaving the teacher free to guide it properly to its appointed end.

The Third Possible Situation

There remains yet a situation more difficult to handle than either of those above. It is that in which the class as a whole has failed to solve the problem with the result that no answers at all are submitted when conclusions are called for at the opening of the discussion.

This is the sign that the questions, prepared in advance and included in the lesson plan, should be used. Although the problem as a whole may be too difficult for the class, they may still be able to do the required thinking a step at a time; and this is what a good list of questions really calls for. Hence this is the teacher's *first recourse* when he finds that the class has failed to solve any problem that has been assigned.

His difficulty, however, is not usually settled so easily as this. For in the list of questions taken up separately, one or more may prove too difficult, just as was the original problem. As a matter of fact, this very frequently happens. The problem arises, What should be done in this case?

Manifestly it is for the teacher to "step the thought down" to the plane upon which the class is able to per-

form it. There are *three ways* of doing this; and by their use the thought may, in apparently any given case, be brought down to a level at which the class is able actually to perform it.

The teacher's *first method* should be to change the thinking into the *concrete form* by citing one or more concrete examples or illustrations and asking what the answer would be in each particular case. It is one of the peculiar characteristics of the human mind that it can think concretely more easily and readily than it can think abstractly. Very often indeed do we find that difficult general or abstract questions are easily solved when put in the concrete form. Hence this may be regarded as a thoroughly sound device for reducing the difficulty of the thinking when the latter has brought the class to a standstill.

Valuable as it is, this plan may still fail and often does so, leaving the question which has proved too hard still unanswered. It is necessary in this case, to reduce the thinking to a *still lower level* as to difficulty. This time an entirely different plan is used. The teacher may now suggest two or three possible answers, one of which should usually be the correct one, asking which of them, if any, is probably right.

Here again, he is taking advantage of a known peculiarity of the human mind. For by some strangely acquired power, it is able to test the conclusions of others even though it can not arrive at satisfactory conclusions of its own. Thus the person who can not, let us say, solve difficult political, social or other problems on his own account can still weigh the solutions of others in the light of his own knowledge and experience and decide whether such solutions are probably

sound or fallacious. This odd fact bears, of course, a vital relation to human progress, since it makes those who can not lead able still to follow intelligently, thus insuring proper support for those who are finding the way onward and upward. Obviously, it is a *most* rational procedure to shift, then, in our classroom difficulty from the type of thinking in which the class is required to *find answers or solutions of their own* to that in which they only have to *test or weigh the answers of others.* Although they can not do the former, it very often turns out that they can do the latter without difficulty.

As a *last resort* the teacher may, in case the preceding methods fail to lead the class to the answer of the baffling question, give such answer himself *together with the evidence,* or reasons why it is believed to be correct. He will, in this case, ask the class simply to decide whether the conclusion seems warranted in light of the evidence. This clearly calls for thinking simpler in its nature than any hitherto proposed. It is real thinking still, however; and the efficacy of this final method is such that it makes the teacher fully able to keep the thought moving forward to the correct conclusion in nearly any situation that can be conceived.

PROBLEMS FOR THE STUDY HOUR

1. Do you believe that a good class discussion can result if a teacher makes it a rule to call first for the facts relating to the problems that have been found by the class, and to ask for the conclusion only after these facts have been stated? Give your reasons fully.

2. In what degree will interest be reduced if the teacher requires the group to repeat, step by step, the solution of a problem that they have already solved before coming to class?

3. It is generally held that the class discussion gives a teacher his best opportunity to develop in his students good thinking ability. What general rule or rules should he observe in connection with the technique given in this chapter, in order that the class discussion may have its greatest possible value in this respect?

4. Choosing a particular problem in your special subject which might in your opinion prove difficult if given to a class of average ability, prepare a series of questions to be used in case they failed to solve it. After this, determine which of these questions would be most liable to prove too hard when put to the group and state the precise questions that you would use in reducing the difficulty of the thinking to each of the three levels, in turn, described in this chapter.

HELPFUL READINGS

PARKER: Methods of Teaching in High Schools, pp. 217–222.
PARKER: Methods of Teaching in High Schools, Chap. 18.
THOMAS: Principles and Technique of Teaching, pp. 272–284.
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ELLIOTT: The Process of Group Thinking, Chap. 9.
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CHAPTER XVIII

EXTEMPORANEOUS QUESTIONING

From the preceding chapters, the impression may have been gained that the only questions that are ordinarily used by the problem teacher in connection with his class discussions are those which he has prepared in advance and included in his "lesson plans."

Although the major questions are really determined in advance, as the techniques have indicated, it is nevertheless true that the teacher must, in leading a group discussion, formulate other questions now and then as the need for them arises.

The number of such questions is, in general, not large. Indeed, really skillful teaching is characterized by the small number of questions used. This is partly due to the fact that a good discussion, once started, will often carry itself along for a considerable time without further questions from the teacher, but partly also to the fact that the questions used are those which call for thinking and that questions of this kind can not be quickly answered. The rule appears to be that the greater the number of questions that are asked, the poorer is the quality of the teaching done. It follows that a ban is placed upon fact questions generally since they are quickly answered.

The simple technique which follows includes the points that should be observed in skillful questioning:

FORMULATING AND PUTTING QUESTIONS

1. In guiding the thought of the class, make use, when necessary, of improvised questions which

   a. Call for thinking.
   b. Are interesting.
   c. Lead the thought forward, step by step, to the desired end.
   d. Do not in any way suggest their own answers.

2. At the beginning of the discussion, call only upon persons who exhibit strong *interest*. After this interest has spread through the class, observe no fixed order in calling upon individuals. Instead follow such order in any given case as shall keep the thought properly "balanced" for a suitable time as between opposing views or opinions. Look through the class roll occasionally to make certain that no pupil is being unconsciously overlooked.

3. After any given question has been stated, pause long enough to permit the necessary thinking to be done, before calling upon any person to answer it.

4. After answers have been given, require that they be justified by sound reasons. Accept no opinions unsupported by facts.

5. Call for written answers occasionally, especially when questions are important and may be answered briefly.

The Nature of the Questions

At first thought, it may seem that the characteristics of good questions are really the same as those which have been specified for good problems. However, the standards required in good problems are somewhat too difficult to be applied on the instant, as is often necessary when formulating and putting questions in the midst of a class discussion.

The first characteristic of a good question given in the technique is one with which readers of this book will readily agree. It must be a "thought question," rather than a fact question. This seems entirely logical when the general tenor of the preceding chapters is considered. Yet we should note that it really closes the last possible door to the traditional type of fact teaching. If the problem teacher may at any stage of his work call for facts as such, it may properly be only when the class is engaged in a discussion which will actually turn upon these facts. There may be cases in which this is the proper thing to do, but it is nevertheless quite certain that such occasions are rare. In general, it is better in such cases to put thought questions instead of fact questions; and the reasons that are offered by the class members for the answers given will, if the questions are well chosen, prove to be the facts that are desired. Thus the rule may well be to renounce fact questions under virtually all conditions; or if they are used at all it should be only in those rare cases when satisfactory thought questions can not be devised.

In similar manner, each question must carry a "charge" of new interest. This is necessary not merely to the end that interest may be increased as the discussion progresses, but because even one or two uninteresting questions may greatly diminish the interest already aroused.

The demand that each question be interesting requires that the teacher be alert to involve natural impulses or external connections, or to apply other classroom interest skills as opportunity offers.

That the questions lead forward "step by step,"

that is, in unbroken sequence to the appointed end, as stipulated in the technique, is a matter of the utmost importance in problem teaching. This is owing to the fact that questions not closely and naturally related in this manner often throw the thinking of the entire group into a state of confusion, making it impossible for them to attain a really clear understanding of the problem as a whole.

The Suggested Order of Questioning Pupils

It is self-evident that no fixed order of putting questions to students should be followed.

In general, two rules govern the order in which individuals should be called upon. In the early stages, the plan followed is that suggested on page 50 for spreading interest through a group by means of the natural impulse of sympathy. It plainly implies a permanent injunction against the too common practice of calling upon those who are not "paying attention." To call thus upon students who are not interested results, as stated elsewhere, in spreading, not interest, but "lack of interest" through the class.

After the impulse of sympathy has played its appointed part in the dissemination of interest, a shift should be made to the technique for establishing and maintaining suspense given on page 69.

The Need of Time for Thinking

If one really uses fact questions, he may expect answers to be given quickly if at all. This is far from true if thought questions are used instead. Now the

students must not only recall the facts that are needed but they must also *use them* in reaching a decision or conclusion. Manifestly, more time is required for this process than is needed merely to repeat the facts from memory. It is therefore to be regarded as a serious mistake to call for the answer of any given thought question immediately after it has been asked. Indeed, hardly any mistake in the technique of questioning can be worse save, perhaps, that of calling the student's name before the question is put.

The Requirement that All Answers Must Be Justified

The traditional rule that questions answered by *yes* or *no* or other questions similarly offering but two alternatives should not be asked, apparently does *not* apply in problem teaching. This is due to the fact that no question is regarded as answered until the reasons for the answer given are stated and found valid.

It is a nearly invariable rule in problem teaching that answers without reasons can not be accepted. In general, the reasons will tend to accompany the answers, though it is permissible at any time for the teacher to request that reasons be withheld until all answers have been given, as is done when the discussion of the general problem is being opened.[1] The advantage of this method is found in the careful weighing process that almost invariably takes place when the reasons are thus arrayed against each other in orderly manner at the beginning. The thinking that results is unquestionably far better than that which

[1] See page 148.

occurs when each answer is directly followed by the reasons that support it.

If reasons are, then, to be demanded in all cases, the question having but two possible answers may be as desirable as any other. Indeed, a very large number of judgment problems require merely a choice between two alternatives. Among them are many calling for thought of the highest quality.

PROBLEMS FOR THE STUDY HOUR

1. Should pupils be allowed to answer questions without being called on?
2. Should those pupils whose hands are raised most frequently be called upon most frequently?
3. Under what circumstances, if any, would a teacher be justified in asking fact questions?
4. Do you believe that a good teacher can be generally recognized by the small number of questions which he asks?
5. Should answers of thought questions be accepted without reasons?
6. Which of the rules for good thinking should receive most careful attention from the teacher while pupils are answering his extemporaneous thought questions?

HELPFUL READINGS

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AVENT: Beginning Teaching, Chap. 10.
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CHAPTER XIX

DETERMINING THE KNOWLEDGE TO BE TAUGHT

The caption above seems to imply that teachers generally are permitted to decide for themselves what knowledge they will teach, and what they will omit in connection with any given course.

The truth is, of course, that most teachers are expected to present the material included in the text that happens to be in use. It is still for them, however, to discriminate between the essential facts to be taught so that they will be retained and those which should be taught only so that they can be found when wanted. Obviously, all teachers should be able to make this broad distinction, at least as to the facts that fall clearly into one or the other of the two great classes named.

Of all the teaching skills, this one of separating essential knowledge from that which is relatively non-essential is one of the most difficult. A technique which is helpful in that it renders the subjective process more definite and accurate is given below:

SELECTING THE FACT MATERIAL TO BE TAUGHT

1. Make a list of the large, specific *interests, ideals, abilities,* and *appreciations,* which you wish your course to develop in your students.

2. Refer to texts, bulletins and other similar sources for fact material that will clearly prove of value in developing the specified interests, ideals, abilities or appreciations. By the method described below, arrange those facts which seem of value in *two lists,* the first containing those which are to be so taught that they will be retained, and the second containing those which students should merely be able to find and use.

3. To determine in which list a given fact should be placed, score it as to (a) *interest,* (b) *understanding* and (c) *usefulness.* In scoring each of these, use the scale of 0 to 5.

4. In case the total score on any given fact is 10 or more, regard it as an essential fact to be taught so that it will be retained until needed, and place it in the first list named above. If the total score is less than 10, place it in the second list; or if its score is very low, as will often be the case, discard it altogether.

5. In case the list of essential facts suitable to use in developing any given interest, ideal, ability or appreciation is found to be insufficient, search without ceasing for others of the desired type until a sufficient number is found.

The Beginning Points in Selection

In a previous chapter,[1] it was said that the acquisition of knowledge is not to be regarded as the true end of teaching but only as a means to the true ends, which are in general interests, ideals, abilities and appreciations.

It is, then, entirely proper that we should seek first to designate *specifically* the interests, ideals, abilities and appreciations which should be developed in connection with a given course before undertaking to discriminate between its essential and non-essential subject matter.

[1] See page 5.

This task of designating by name our specific objectives, even though these are few in number, requires, as a rule, the most careful thought of which we are capable. It is comparatively easy to list the *facts* relating to a given subject in the outline form commonly referred to as a "course of study"; but it is a very different matter to name in a similarly definite manner the particular interests, or ideals, or abilities, or appreciations which we wish the course to develop in our students.

We should not miss the true significance of this first step of the technique. It means that the knowledge to be taught in our courses is actually to be determined by the *ends* to be attained; that when these ultimate ends have been specified, and not until then, may the fact material to be taught be intelligently chosen; and that no knowledge should be taught that does not contribute clearly and directly to one or more of the specified ends that are to be realized. When any traditional course of study, consisting of an outline of fact material more or less blindly chosen, is measured by this three-fold standard, it is ordinarily found to be sadly wanting.

Determining the Facts to be Retained

In the second chapter of this study, the hypothesis was evolved that retention of knowledge depends upon (1) interest, (2) understanding and (3) subsequent use in thinking. All the so-called teaching skills treated in this study have been born of that hypothesis.[2] It seems, then, quite proper that the three properties or

[2] See Chapter III.

qualities named above should, as stipulated in the technique, govern the process of selection of the facts which are to be taught so that they will be retained. Manifestly, we should not hope for nor attempt to secure the retention of facts that can not be retained, though it can not be denied that a rather large part of the facts that have hitherto been taught seem to fall into this class.

Separating Out the Essential Facts

The technique suggests that the actual classification of any given fact, as essential or non-essential, should be determined by the score given to it on *interest, understanding* and *usefulness.*

As an example, let us take the fact that our form of government was designed by its founders to rest upon the so-called "party system" in the belief that this would make for a greater degree of honesty in the administration of public affairs than could otherwise be secured.

One of the specific *objectives* of the course in United States history is the *ability* to discharge the duties of citizenship intelligently; and one of the *problems* that should be put to the class in endeavoring to develop this ability would probably be stated in some such form as the following:

> Should a good citizen vote the straight party ticket, or should he vote instead for the men and principles that seem to him most nearly right, irrespective of party?

It is evident that this would be one of the most important problems that could be included in a series

to develop the ability named, and also that, whatever the solution of this problem, the fact stated first above should be given most careful consideration in arriving at a conclusion. With these things in mind, let us score the fact in question.

Owing to the appeal to gregariousness and perhaps to altruism, it is quite strongly interesting, though not intensely so. The score on *interest* should therefore be set at 3 or 4.

In general, the fact is understandable, though some students might not see clearly just why the party plan *should make for greater honesty in public officials* as the founders of our nation seemed to think it would do. The score on understanding should be again 3 or 4.

The fact is useful in that it functions clearly and directly in the development of a specific ability which is one of the the ultimate objectives of the course. For this reason, and also because it may normally be expected to recur more or less frequently in the thinking of the young people in later life, its score as to *usefulness* should be 5.

It follows that the minimum total score of the fact designated is 11. According to the technique, it would therefore be included in the list of essential facts to be taught so that they will be retained.

Let us turn to another fact in American history, namely, the so-called Trent Affair, which nearly resulted in an open break with Great Britain in 1861.

This fact is distinctly *lacking* in interest to the average group of high school students, though somewhat less so to college students as a rule. It is only partly understandable, since it involved a rather abstruse principle of international law. It lacks useful-

ness in that it does not contribute clearly to any important objective in American history and does not enter into the thinking of the average American citizen in later life. In view of these considerations, its score on *interest* should be 1 or 2; on *understanding,* 2; and on *usefulness,* perhaps 0. Since its maximum total score would be 4, it should be placed in the list of non-essential facts to be taught, not so they will be retained, but merely so they can be found if needed.

A Difficulty Met in Selecting Subject Matter

By the simple process described above, any given fact may be readily evaluated and classified with reasonable accuracy as essential or non-essential, though it is true that in judging subject matter, as in judging problems, genuine skill requires much careful practice.

When we have applied the scoring process to each of the apparently important facts included in an outlined course of study, we ordinarily find that very many of them fall into the group designated here as non-essential, or even in some cases that they should be rejected altogether. Usually, too, it turns out that the number of essential facts is not adequate for the actual attainment of certain objectives that have been specified and that should be accomplished without fail.

The foregoing is the "acid test" of a course of study; and it often reveals deep-seated but fundamental faults. After it has been applied, the typical high school or college course may, and often does, look very sorry indeed. With many of the facts previously emphasized removed over into the non-essential list,

it becomes the teacher's duty in such cases to find others that will function effectively in the realization of the respective objectives which he wishes to attain. By reference to various texts, to encyclopedias, or to other reliable sources, he may find the additional facts that he needs. It can hardly be questioned that in bringing together in this manner a body of knowledge all of which is essential to the realization of the great, ultimate ends of his work, he will have performed one of the highest functions that can fall to his lot as a teacher of the youth in our schools.

PROBLEMS FOR THE STUDY HOUR

1. By what standards do the facts which you have been required to learn in high school and college seem to you to have been selected?

2. Would the standards of selection suggested in this chapter exclude anything worth while found in the traditional courses?

3. Assuming that all high school and college courses were made in the manner suggested by this technique, do you believe that their value to students would or would not be much greater than at present?

4. Determine specifically the *major* interests, ideals and appreciations that should be developed in connection with a course which you teach or expect to teach.

5. If the standards of this chapter were applied to a typical course in United States history, about what percentage of it would you expect to see placed in the list of essential facts?

6. Suppose that by the process described in this chapter the body of knowledge in a given course were reduced by 50 per cent, but that this were taught by means of well-selected problems. Would you expect the class to *retain*

permanently a greater or a smaller absolute amount of fact material from the course than if the change had not been made?

HELPFUL READINGS

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DEWEY: Democracy and Education, Chap. 14.
THORNDIKE: Educational Psychology, pp. 178–186.
DEWEY: How We Think, Chap. 5.
HERBERT SPENCER: Education, Chap. 1.
PARKER: Methods of Teaching in High Schools, pp. 67–80.
SNEDDEN: What's Wrong with American Education, pp. 32–36.
STREBEL and MOREHART: The Nature and Meaning of Teaching, pp. 30–41.
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THAYER: Passing of the Recitation, pp. 126–132.
KILPATRICK: Foundations of Method, Chap. 17.

CHAPTER XX

THE MEASUREMENT OF RESULTS

The ability to repeat facts from memory is very different from the ability to apply them readily and accurately in new situations. Indeed, we may say that the mere possession of knowledge falls so far short of the ability to use it well subsequently in life that it can not by any sound doctrine be justified as an actual index or measure of the latter. It follows that mere information tests are, in general, to be regarded as false and misleading measures of the true results of teaching.

It is not easy to find methods of measuring the results of our work that are wholly acceptable. Just as the best teaching concerns itself largely with training the students to use skillfully the knowledge that is taught, so the best tests should actually measure this ability to use it, as well as the disposition to do so voluntarily.

The technique which follows suggests several usable methods of discovering the extent to which students are able to apply in their own thinking the knowledge that they have acquired.

MEASURING THE RESULTS OF TEACHING

In attempting to measure the results of teaching, make use of methods which will test not mere possession of knowledge,

but the tendency to use it spontaneously in thinking. In order to determine whether knowledge is actually used by students in this manner, employ any effective combination of the plans suggested below:

1. Observe closely the contributions of individual pupils in daily class discussions, with a view to determining the ease and readiness with which they bring essential facts, already studied, into the new thought. No record of such observations needs be kept unless the class is large.

2. Give short written tests, preferably lasting but a few minutes each, on single thought questions involving essential facts already studied. Such tests may be given at any appropriate time during the class hour, but are especially valuable if used at the beginning as a means of introducing the day's work as suggested in the technique for making internal connections given on page 54.

3. Call for written solutions of new problems, as a part of the regular assignment, but with the unannounced intention of regarding them as a part of the final test in the course.

4. Require students to prepare in writing careful discussions of certain large divisions, topics, or problems of the course. Prepare in each case a list of well-chosen thought questions to guide them in such original discussion. Require that all conclusions or opinions shall be supported by thoroughly sound reasons; that thought shall be clearly expressed; that proper literary standards shall be observed; and in general, that each paper of this kind shall represent the best thought of which the student is capable, expressed in the best English at his command. Have these papers, if written, bound together and preserved as the permanent notebook of the course.

5. Avoid tests consisting of mere fact questions, or tests of any kind announced in advance.

The Need of Watching Spontaneous Thought

If we should become able, in the future, to measure accurately the true results of teaching, we should probably find that a surprisingly high correlation exists between these results and the readiness or ease with which our students apply in the discussion of subsequent problems the facts and principles that have been acquired.

Readiness in applying knowledge in school should go along with readiness in applying it in later life; and the student who is found using the newly acquired facts and principles spontaneously and habitually in the informal thought of the classroom may safely be assumed to be the one who will use it in the same manner after his school days are over. On this ground, the suggestion of the technique that we should note carefully the facility or ease with which the various students weave their knowledge into new thought seems justified.

Again, in the second method suggested an attempt is made to determine the degree in which the students have made the recently acquired knowledge a part of themselves. In this case, a new thought question, involving facts or principles that have been studied, is put to the class without previous warning, and written answers are asked. Those who are found using the needful knowledge under these rather unfavorable circumstances may be regarded as at least more liable than those not doing so to use it in the unexpected situations of post-school life.

determining what degree of retention may be expected? State your reasons clearly.

2. Assuming that we wish further to take into account the quality of thinking done by our students, as suggested in the eighth teaching skill (page 109), how would you rank the four methods given as to their value from this standpoint?

3. If it is assumed that we should measure results in terms of the ultimate objectives which we are endeavoring to realize, that is, interests, ideals, abilities and appreciations, how should the four methods given be ranked?

4. Describe other methods of measuring the results of teaching that seem to you good when judged by the standards given above.

5. Are these to be regarded as true and valid standards to keep in mind when trying to measure the results of our work?

6. Please give your best judgment of information tests announced in advance as measures of teaching, endeavoring to take into account all facts that should be considered and giving to each the weight that it should have.

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CHAPTER XXI

AN OVERVIEW OF PROBLEM TEACHING

As our study nears its close, we may apparently turn our attention with profit to certain perplexing questions that have probably come to thoughtful readers as the various procedures of problem teaching have been taken up in the preceding chapters.

One of these is, Is it really possible to teach *all* subjects by means of problems, as seems to have been implied throughout this book?

In theory, at least, it is entirely possible to do so in the case of every secondary or college subject that is worth teaching at all. This statement is based upon the fact that problems are born of life situations in which the principles that are being studied are actually applied. If such situations really exist, then the necessary problems can be found. If not, the subject matter is evidently not used outside of school and should therefore not be taught.

In practice, it can not be denied that teachers find it difficult at times to secure satisfactory problems for use in their classes. However, the difficulty seems to arise as a rule in their own lack of knowledge as to how the principles are actually used in the affairs of life. It is, of course, true that they themselves have rather commonly studied their subjects as things more

or less apart from life and with little consideration of their applications in the world of affairs. Thus through no fault of their own they find it difficult to put their work on a true problem basis. Despite their innocence in the matter, however, they should recognize their deficiency for what it really is—a genuine and serious weakness in themselves. This is no less true if they teach by the traditional methods than if they endeavor to teach by problems. In the one case, as in the other, they should earnestly strive to overcome it by a diligent and painstaking study of the many specific situations in which the knowledge that they teach actually functions in the ordinary affairs of life. In the degree in which this is done, their difficulties with respect to procuring suitable problems for teaching purposes may confidently be expected to vanish.

The Danger of Fragmentary, Disorganized Knowledge

Misgivings have been expressed at times lest students who acquire their facts and principles through problems may fail to organize them systematically in their own minds. Thus their store of knowledge might conceivably become a formless mass of unrelated fragments rather than an organized system in which the relationships of part to part are clearly seen and understood.

Again, the danger must be recognized as really existing; and again it lies within the power of the teacher to avoid it by proper effort.

If teachers, for example, actually determine the objectives of their respective courses in terms of large,

important interests, ideals, abilities or skills, and appreciations, as has been contemplated throughout this study; if these objectives are arranged in easy, natural sequence for teaching purposes; if in attaining them problem series are used in which the sequence of inductive, reasoning or judgment, and creative steps suggested in Chapter XIV is followed; and if in handling the work in their classes, the technique for making internal connections, as given in Chapter VII, is carefully observed; then an organization of the material studied should result in the minds of the students that is distinctly superior to that ordinarily found in textbooks or in outlined courses of study.

The reason for this is that the organization that would result from the procedures suggested above would for the most part be determined by and based upon relationships of cause and effect, whereas that resulting from the conventional study of textbooks and outlines of subject matter is ordinarily based upon relationships of comparison, that is, upon classifications arising out of observed similarities or differences.[1]

It may fairly be questioned whether students who learn lessons from the conventional textbooks really have at the end of a course, as a rule, what might be properly called an *organized system* of knowledge. Be this as it may, such organization as they are assumed to get is still clearly inferior to that which should result from the use of the procedures described in this book. This is because relationships of comparison can, generally speaking, only be *memorized*, whereas those of cause and effect can be *understood*.

[1] See page 58.

Problem Teaching and the Objectives of Education

It is fitting that every educational proposal in our time be tested by comparison with the great educational objectives, to the attainment of which the efforts of our American public school system are dedicated. These objectives, as sponsored by the National Education Association and endorsed by nearly all other important educational organizations and agencies of our nation, are:

1. Health.
2. Command of fundamental processes.
3. Worthy home membership.
4. Vocation.
5. Citizenship.
6. Ethical character.
7. Worthy use of leisure.

Clearly, the relationship of problem teaching to these great educational objectives needs to be determined most carefully; for if it should in any manner hinder their realization, then it should be quickly rejected.

We should observe, first, that these objectives all demand imperatively that the knowledge learned in school be *used* in later life; and this in turn makes its *retention* a matter of absolute necessity.

As we have seen in this study, the plan of teaching by problems, with all its puzzling ramifications, has come directly out of, and in fact actually represents, and effort to teach knowledge so that it will be retained. That is, retention was held in the beginning to be determined chiefly by *interest, understanding* and *subsequent use in thinking.* Of this trinity, the last two gave

rise to the problem series, in which the first type of problem, the inductive, yields *understanding,* whereas reasoning, judgment and creative problems provide *subsequent use in thinking.* Thus we say that problem teaching promises to give *retention* in a measure such as can not be expected from other methods, generally, and that it also provides constant practice in the application or *use* of the knowledge learned. Thus the first fruits of problem teaching are the precise ones which are seen above to be mandatory if the objectives of our public school system are to be realized.

To put the matter differently, yet none the less clearly, if we take each of the above objectives in turn, we find that if it is actually to be realized in our youth, we must (1) arouse their *interest* in it; (2) establish *in them certain specific ideals with respect to it; (3)* develop in them certain definite *abilities* or *skills* with respect to it; and (4) create in their minds appropriate *appreciations* relating to it. It is exceedingly doubtful if any one of the great objectives named can be fully realized in any individual in any other manner whatsoever.

These four—interests, ideals, abilities and appreciations—have been constantly kept in mind throughout this study. Moreover, it has been shown that these worthy goals may actually be attained by means of well-chosen properly arranged problems whose solution will bring students to the appointed ends through processes of their own thinking.

The conventional lesson-learning process, which seems to rest upon the assumption that acquisition of knowledge is the end sought, manifestly contributes little, by comparison with the above, to the great objec-

tives of our American school system. It offers little assurance that knowledge will be retained, ordinarily provides small occasion for its use, reduces thinking to a minimum, and follows an order based upon artificial classifications of comparison having no conceivable relationship to the objectives of education. If in any given case it is found functioning favorably with respect to these objectives, it is, in general, by virtue of the adoption of certain features inherent in problem teaching as the latter has been treated in this study.

Problem Teaching and Stimulus-Response Bonds

It is rather easy for one who is familiar with the commonly accepted principles of psychology to question the soundness of problem teaching because it seems to rest upon no familiar psychological foundation.

The belief is quite general, for example, that the learning process is essentially one of establishing so-called stimulus-response bonds in the minds of students. Thus we may desire a certain symbol, Fe, to bring to their minds a given chemical element, iron; or a given word, calorie, to remind them of the quantity of heat that is required to raise the temperature of one gram of water one degree C. In the first case, the symbol is referred to as the stimulus, and the actual recall of the element, as the response. So in the other, the word is the stimulus, and the recall of the definite amount of heat referred to, the response. If the response can be made, then we say that the stimulus-response (S→R) bond has been established. Hence the learning process seems to become merely one of forming S→R bonds.

This conception of learning is doubtless a true one as to the simple, elementary learning process. However, it should be observed that it seems to reduce learning to the basis of pure habit formation; that it is primarily concerned with simple acquisition of knowledge rather than with its retention; that it has no reference to the manner in which the knowledge functions, and so on. In short, it seems to represent the precise type of learning from which problem teaching promises to emancipate us. Viewed in this manner, it is easy to conclude that there is a fundamental conflict between the two conceptions of how students really learn.

However, there is a broader yet entirely legitimate conception of the S→R bonds which brings the two theories into virtual accord. Such a bond may be established between a stimulus and a response having no relation to each other save one that is arbitrary and artificial as in the second instance above. In this case it can be established only by repetition, that is, by a process of habit formation, as has been suggested. On the other hand, such a bond may exist as truly between a stimulus and a response having an entirely natural relation to each other. This would be true as to cause and effect bonds, generally. Between a concrete effect, for example, and the general law producing it, such a bond clearly exists.

Now in all types of problems considered in this study, cause and effect bonds are established. Thus in the inductive problem, a concrete situation, which is to be regarded as an effect, serves as the beginning point, and it is required that its cause or causes be discovered. Such cause or causes will ordinarily turn

out to be general truths or principles operating in the given situation. However, between the concrete situation and such general truths or principles, when the latter are found, there exists a true S→R bond, in this case one of cause and effect.

In the same manner, in reasoning, judgment or creative problems, which comprise the remainder of the problem series, the general principles or causes are applied to specific situations or effects. Although the direction of the thought is, in general, reversed, it is none the less true that a genuine bond of the cause and effect type is established in every case. Yet in these cases the establishment of the particular bond between the general truths or principles and the *specific* situations described is not the end desired so much as the establishment of a strong generalized bond, let us say, between the general truths or principles on the one hand and *all* of their applications, taken as a general group, on the other.

Thus whether the bonds are purely artificial and arbitrary or of the cause and effect type, they are S→R bonds still. In the one case, the learning process is necessarily a matter of habit formation; in the other, one of understanding and applying, that is, one of thinking. It follows that the S→R bonds are as truly involved in the one type of learning as in the other. Moreover, since bonds of the cause and effect type are, in general, established not by a process of mechanical repetition but by and through the normal functioning of human intelligence the superiority of that type of teaching which seeks to establish them can hardly be challenged or denied.

Problem Teaching and Thorndike's Laws of Learning

Our thought in recent years relating to the learning process has tended to center about the three laws of readiness, effect and exercise enunciated by Dr. Thorndike in his monumental work on educational psychology.[1]

The *law of readiness* states that if the response to a given stimulus is ready to be made, for it to be made is satisfying and for it not to be made is annoying; and further, that if the response is not ready to be made, then for it to be made is annoying.

The *law of effect* holds that if the establishment of a bond, or connection is accompanied or followed by satisfaction, the bond itself is thereby strengthened, whereas if it is accompanied or followed by dissatisfaction the bond is thereby weakened.

The *law of exercise* stipulates that when a connection is made between a stimulus and a response, the strength of the connection, or bond, between them is increased.

Students of this book have probably sensed some sort of hidden relationship between the requirement of *interest,* regarded here as a first condition of true learning, on the one hand, and the laws of readiness and effect, as given above, on the other.

Such a relationship exists in the sense that, if the mind is interested in a given situation, a state of readiness to respond to it exists, and further, that, in this circumstance, the response ordinarily gives satisfaction. It is true that the conception of interest which has been reached in this study is apparently somewhat

[1] Thorndike: Educational Psychology, Vol. II, p. 1.

broader and more far-reachng than that which seems to be expressed or implied in the laws of readiness and effect. Suspense, for example, would hardly be permitted by the law of readiness; yet it is known to be highly effective in securing and holding interest. Although other similar instances might be cited, it is still true that, in general, there is substantial accord between the two laws in question and the doctrine of interest which has had so large a place in this study.

The law of exercise, on the other hand, seems to hold for a thing that has been in part repudiated herein, namely, learning by sheer *repetition.* In its place has been put another method, similar to it in some respects, yet different in others that are of really fundamental importance. Instead of repetition we have *subsequent use in thinking.* This, of course, implies a certain kind of repetition; yet it should not be overlooked that in this case neither the identical stimulus nor the identical response is usually repeated, as in the case of learning by repetition. Rather, the principles or truths are met in new situations; and because the situations, or stimuli, are new the responses are likewise new. Hence we have not a repetition of the *same* S→R bond, as the law of exercise demands, but a succession of different S→R bonds. It is true, of course, that in thinking the original bond is actually re-established. However, it is merely added to the new situation, thus becoming a part of the stimulus. Therefore the bond that is established is a new one.

It follows that there seems to be a deep-seated conflict between the *law of exercise* and the requirement of *subsequent use in thinking.* The great difference

lies in the thinking element, which the one does not call for whereas the other does. Whether this is really necessary in order that knowledge may be retained and in order further that students may be able to apply it in later life, as required by our educational objectives, may safely be left for time and experience to determine. Upon the issue will hang the vital question of whether the learning process is, in the case of high school and college students, essentially a mechanical one involving simply the formation of habits by rote or drill processes, or whether, on the other hand, it is one involving human intelligence.

Let us, however, note still another point in which there appears to be a fundamental disagreement between Dr. Thorndike's laws of learning and the fundamental hypothesis of this book. It has been held here that retention of knowledge is determined chiefly by *interest, understanding* and *subsequent use in thinking.* As has been shown above, the laws of readiness and effect may be regarded as approximating the factor of interest first named in our hypothesis, and the law of exercise has something at least in common with the third. There is left, then, the second, which makes understanding an essential feature of the learning process.

It should be freely acknowledged that it is necessary at times for our pupils to learn things that they can not understand. However, much more of such learning is required of elementary children than of those in the higher grades. Since we are concerned here rather with the work of high school and college students, and since understanding appears to play so important a role in their permanent learning, there seems to be

ample ground for questioning strongly, on this score alone, the validity of the law of exercise in connection with the learning process of secondary and higher students. At these levels, understanding must, it seems, be looked upon as a factor of utmost consequence. So, too, must subsequent use in thinking, discussed above. *Intelligent human beings do not learn as the lower animals do.* There is something repugnant in the thought that these relatively mature minds, accustomed to active thinking and normally engaged in fixing knowledge by this means in the ordinary round of life, must be kept at the wearisome and childish task of mechanical memorization while in school, world without end. Aside from this, experienced teachers generally of secondary and college subjects agree that learning by repetition is not the best learning at these levels. Moreover, college students, in endeavoring to account for the retention of specific facts remembered by them over a long period of time, seem to hold nearly unanimously that the ones retained have been almost invariably those which were understood and used later in thinking, but *not* those which were learned by mere repetition. In view of these and other considerations, it is hard to see how the law of exercise can be accepted as a sound basis of learning at higher levels.

Problem Teaching and the Ideo-Motor Theory

It is thought by many that the learning process must, in order to be effective, include physical activity on the part of the pupils. This doctrine is probably to be regarded as a variation of that which holds that

learning is essentially a process of establishing S → R bonds, because it demands that appropriate physical responses must be attached to the respective ideas taught.

In problem teaching every effort is made, as has been shown in the preceding chapters, to secure ready, facile application, in concrete situations, of the knowledge taught. It may or may not happen that such application involves physical activity. Neither does it matter whether it does so, since the application of the knowledge, rather than bodily activity, is the end sought.

In this connection it should be kept in mind that the normal application of knowledge is *in thinking* that is, in *mental,* as distinguished from physical, activity. Such thinking may issue finally in bodily movement or it may not do so at all. To say that it must do so is to set a highly questionable standard, at least in the case of high school and college students.

One has only to take a partial inventory of his own store of knowledge to discover that a large portion of it was apparently acquired without any accompaniment of conscious physical activity. On the other hand, thought processes involving the knowledge, such as are called for by the various types of problems considered in this study, seem always, or at least very nearly always, to have been a part of the process of fixation.

To say that all learning must issue in bodily activity is to say that a person can not sit down with a book and learn from it. This is not true as to adults, nor even as to adolescents, regardless of what the truth may be with respect to little children. Moreover, the

learning that results from reflective thinking, such as is done in the solution of many problems, implies no bodily activity either at the time of acquisition or afterward. If it is urged that certain internal physical reactions are involved, the answer seems to be that such reactions are not under conscious control and therefore should not be sought consciously, far less made a pretext upon which to base a demand for outward bodily activity.

The better view seems to be that when the normal application of knowledge is found in activities physical in character, then the learning process should include such activities, but that in those cases, relatively frequent in high school and college, in which the knowledge studied has no such physical application, there is no valid ground upon which to base the demand that such activities shall be provided. This, of course, is in strict accord with the problem method of teaching as presented in the preceding chapters.

The Conclusion of the Matter

The psychology of thinking, and of learning by thinking, has yet to be developed. In general, the phases of psychology that have been most investigated relate to the process of rote memorization. Dr. Bode,[2] who has sensed the need of study along other lines, gives expression to the following opinion:

"There are various movements in education that aim to secure a more effective cultivation of thinking. The movement that advocates teaching by the project method is a case in point. But our thinking about the nature of thinking still

[2] Bode: Modern Educational Theories, p. 218.

leaves much to be desired. It would help to secure a more adequate practical recognition of the importance of thinking if we could clear up our ideas as to what is distinctive in the thinking process, so as to secure clues that would be more serviceable in furnishing guidance for curriculum making and classroom procedure."

It is significant that psychology of the conventional type is silent regarding the processes of judgment and creative thought, which, as has been shown herein,[3] are to be regarded as chief determinants of human success or failure. It is silent, too, as to how good thinkers really think. No reference is made to the rules, or standards, which they habitually observe in solving their life problems. Yet these, and a better understanding of the thought processes referred to above, are among the supremely valuable things that psychology can give to mankind.

To pursue the thought further, psychology would probably come to have much greater values if it would turn its attention to the questions of how to develop strong, lasting *interests,* worthy *ideals,* specific intellectual *skills* of the higher types and genuine esthetic *appreciations* in the minds of our youth. By these alone, as has been said, are our great educational goals to be realized. Yet so far from offering help in connection with these crucial processes, psychology seems to concern itself for the most part with the mere acquisition of knowledge by processes that are essentially mechanical in character.

The foregoing is not to impute intentional fault to those who have labored in the field of psychology. It is a human frailty that, seeing a small part, we imagine

[3] See page *ff.*

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